

UNITED STATES DISTRICT COURT
DISTRICT OF DELAWARE

ROXUL USA, INC.

Plaintiff,

V.

ARMSTRONG WORLD INDUSTRIES,
INC.

Defendant

Civil Action

NO. 17-1258

Hon. Mark A. Kearney

Expert Report of

Professor Einer Elhauge

Time Change

November 30, 2018

HIGHLY CONFIDENTIAL: SUBJECT TO PROTECTIVE ORDER

Table of Contents

Brief Background	1
Executive Summary	2
Questions Asked	6
Qualifications	6
I. SACT Market Definition and Power	7
A. Market Definition	8
1. The Relevant Product Market Is SACTs	8
2. The Relevant Geographic Market Is North America and Within the United States There are Relevant Regional Price Discrimination Markets.	23
B. Competitors and Market Shares	47
1. North American Market Shares	48
2. U.S. Market Shares	49
3. Regional Market Shares	51
C. Market Power and Monopoly Power	57
1. High Market Shares Coupled With High Barriers to Entry and Expansion	58
2. Power over Price	69
3. Power to Exclude Rivals	74
D. Rockfon Is a Market Maverick	74
1. Rockfon Prices More Aggressively	75
2. Rockfon Offers Unique Products	76
II. Overview of Conduct Restraining Rivals	77
A. Why Distributor Foreclosure Restrains Competition	77
B. Armstrong Prohibited Even Non-Armstrong Distributor Locations from Buying Rockfon	84
C. Armstrong Agreements Prohibiting Dealers from Carrying Any Rival Ceiling Products	88
D. Armstrong Agreements Prohibiting Distributors from Purchasing Ceiling Products Directly from Rival Manufacturers	89
E. Armstrong Minimum Purchase Requirements	92

F. USG Exclusive Dealing Agreements with Distributors	97
G. Conflicting Evidence Regarding Certain Teed’s Foreclosure of Distributors	99
III. Foreclosure of Rival SACT Manufacturers	101
A. Foreclosure Shares	101
1. Foreclosed vs. Unforeclosed Classification.....	102
2. North American Foreclosure Shares.....	104
3. U.S. Foreclosure Shares.....	106
4. Regional Foreclosure Shares.....	108
B. Factors Exacerbating Foreclosure Shares	112
C. Examples of Foreclosure Reducing Rockfon Sales	115
D. Statistics Confirming That the Foreclosure Slowed Rockfon’s Growth	121
1. Combined Effect of Armstrong and USG Foreclosure.....	121
2. Isolated Effect of Armstrong Foreclosure	124
3. Rockfon’s Slower Growth Among Foreclosed Customers Cannot Be Explained by Factors That Equally Affect Foreclosed and Unforeclosed Customers.....	127
IV. Anticompetitive Harm	128
A. Foreclosure Impaired Rockfon’s Ability to Compete By Delaying Rockfon’s Investment in a Domestic Manufacturing Plant	129
1. Delaying Domestic Manufacturing Plant Increased Rockfon’s Transportation Costs	129
2. Delaying Domestic Manufacturing Plant Increased Rockfon’s Lead Times.....	130
3. Delaying Domestic Manufacturing Plant Reduced Customer Demand for Rockfon SACTs	131
B. Foreclosure Continues to Impair Rockfon’s Production Efficiency By Depriving Its Domestic Manufacturing Plant of Economies of Scale.....	131
C. Regional Foreclosure Raised Rockfon’s Distribution Costs and Impaired Regional Distribution Competition.....	134
V. Absence of Offsetting Procompetitive efficiencies	137
VI. Damages.....	141
A. Rockfon Revenues in Actual and But-for Worlds	141

B. Incremental Profit Margins in Actual and But-for Worlds	144
1. Actual Rockfon Incremental Profit Margins	145
2. But-for Rockfon Incremental Profit Margins	147
C. Lost Profits	151
VII. Rockfon Would Have Expanded Capacity Faster in the But-for World to Keep up With Its Faster Growth in Sales	153
A. Rockfon Would Have Built Its Domestic SACT Manufacturing Plant Earlier in the But-for World.....	154
1. Profit-maximizing Firms, Including Rockfon, Make Decisions About When to Invest in Expansions Based on Net Present Value	154
2. Foreclosure That Slows Growth Delays the Date When Investing in a Domestic Manufacturing Plant Has Positive Net Present Value.....	155
3. Rockfon Based Its Actual Decision About When to Build Its Domestic Manufacturing Plant on the NPV Given That Market Was Foreclosed.	158
4. In the But-for World, Rockfon Would Have Expanded Capacity by Building Its Domestic Manufacturing Plant Whenever North American Demand Necessitated It, Just As Rockfon Did in the Actual World.....	159
5. Domestic Manufacturing Plant Had Enough Capacity to Supply the Lion's Share of Rockfon's But-for U.S. Demand on Its Own.....	163
B. Rockwool Had Sufficient Production Capacity in Poland to Satisfy the Additional Demand in the But-for World Until the Domestic Manufacturing Plant Opened	164
C. Documents That Armstrong Purports to Show Rockfon Capacity Constraints Actually Indicate Standard Profit-Maximizing Production and Capacity Planning	169
1. Evidence That Rockfon Waited to Expand Capacity Until Demand Justified It	169
2. Evidence That Rockfon Only Ordered the Production Of As Much As It Expected to Sell	170
Exhibit A: Einer R. Elhauge CV	174
Exhibit B: Statement of Publications, Prior Trial and Deposition Testimony, & Compensation.....	187

BRIEF BACKGROUND

1. The Defendant, Armstrong World Industries, Inc. (hereinafter “Armstrong”) has been the largest manufacturer of suspended acoustical ceiling tiles (“SACTs”) in North America for over a decade, and alone has accounted for 60% of SACT revenue in North America since at least 2013. USG is the second largest SACT maker in North America, with a market share of [REDACTED]%. The Plaintiff, Roxul USA, Inc., is a subsidiary of the company Rockwool, which has manufactured and sold SACTs in Europe for decades. In 2013, Roxul USA began selling SACTs in North America under the brand name “Rockfon.”¹

2. Manufacturers such as Armstrong, USG, and Rockfon sell the lion’s share of their SACTs to distributors, who then resell the SACTs to the contractors that install the SACTs into buildings. By the time Rockfon began selling SACTs in North America, Armstrong had already entered into agreements with essentially all of its distributors prohibiting them from buying SACTs directly from rival SACT manufacturers or actively trying to promote rival SACTs instead of Armstrong SACTs. USG also had agreements that foreclosed its distributors to rivals like Rockfon. Internal communications show that Armstrong worried that Rockfon would steal a significant portion of its market share in the United States, especially because Rockwool had already achieved a 30% market share in Europe while competing against Armstrong there.² Shortly after Rockfon started selling SACTs in North America, Armstrong entered into even more agreements with distributors that restricted the purchase of rival manufacturer SACTs, with some agreements explicitly prohibiting distributors from buying Rockfon SACTs in particular, even at branches that did not carry Armstrong SACTs. Armstrong’s own agreements foreclosed about 50% of the North American market, and Armstrong and USG’s agreements collectively foreclosed around [REDACTED]% of the North American market.

¹ Rockfon North America is also the name of the operating division within Rockwool that is responsible for selling SACTs in North America. Rockfon North America is not legally a separate entity from the Plaintiff Roxul USA. *See* Personal Medio Deposition at 13-14.

² AWI00016871 (September 2012 internal Armstrong email stating “Rockfon entered the European market and was able to gain approximately 30% market share in a relatively short period of time, we cannot afford for this to happen in the Americas.”); AWI00016727 (internal Armstrong document [REDACTED]).

EXECUTIVE SUMMARY

3. **A. The Relevant Markets.** The relevant product market consists of all suspended acoustical ceiling tiles (“SACTs”). Rival manufacturer SACTs are the only products that provide the combination of: (i) noise reduction, (ii) clean, unobtrusive appearance; and (iii) coverage of and access to the plenum (the space above ceiling tiles that typically contains ductwork and wiring), at a price that is comparable to Armstrong’s SACTs. My conclusion that a product market limited to SACTs is sufficiently broad is confirmed by other evidence, including that Armstrong, a sub-100% monopolist in SACTs in North America, has been able to profitably charge prices at least 5% above the competitive level.

4. The relevant geographic market for judging most of the anticompetitive foreclosure effects in this market is the North American market (the U.S. and Canada) because these effects depend on total foreclosure throughout North America and cause harms that are felt by every customer throughout North America. For the Court’s convenience, I also calculate market shares and foreclosure shares for a market limited to the United States, given the Court’s ruling that its jurisdiction is limited to the United States. Within the relevant geographic market, there are regional subsets of those markets that can and have been charged different prices in a way that makes them relevant price discrimination markets within the broader geographic market. I define a set of 61 regional price discrimination markets within the United States based on Armstrong’s definition of “Price Metros,” which directly show the regions over which Armstrong believes it can profitably charge distinct prices, and based on data that confirms this ability to maintain distinct prices in these different regions. Customers in higher-priced regions cannot evade those higher prices by substituting to lower-priced regions because of transportation costs and manufacturers’ territorial restrictions.

5. **B. Market Power.** In North America as a whole, Armstrong has monopoly power, based on three independently sufficient bases: (1) high market shares (more than 60% of North American and U.S. revenue in every year from 2013-2017) combined with high barriers to entry and expansion (including the need for an efficient domestic plant, economies of scale, patents, and Armstrong’s foreclosing conduct); (2) direct proof that Armstrong has power over price, for example that it charges over ■% higher prices than Rockfon for comparable products; and (3) direct proof that Armstrong has the power to exclude rivals, for example that Rockfon has grown significantly faster among unforecasted customers than among forecasted customers throughout North America. The

evidence also indicates that Armstrong has market power and monopoly power in the vast majority of the regional price discrimination markets within the United States. Armstrong has greater than a 50% market share in [REDACTED] of the 61 regional price discrimination markets within the United States, depending on the year. In addition to all the barriers to entry and expansion that apply to North America generally, each regional market has the additional barrier to entry and expansion of access to regional distributors, much of which has been foreclosed by Armstrong.

6. The evidence also indicates that the second-largest SACT manufacturer in North America, United States Gypsum (“USG”), has market power but not monopoly power in North America, with on average a [REDACTED]% share of SACT revenue in North America (or [REDACTED]% in the U.S.), depending on the year. USG also has market power in many of the regional price discrimination markets within the United States; it has a [REDACTED]% or greater market share in 24-28 regional price discrimination markets, depending on the year. USG’s market power is relevant because the evidence indicates that USG has also entered into exclusive dealing agreements with distributors that have contributed to the marketwide foreclosure.

7. **C. Foreclosure of Rival SACT Manufacturers.** Armstrong’s exclusive dealing agreements have significantly foreclosed rival SACT manufacturers in North America. Armstrong’s agreements on their own have foreclosed 46-51% of SACT revenue in North America and the United States, depending on the year. Combined, Armstrong and USG have foreclosed at least [REDACTED]% of SACT revenue in North America and [REDACTED]% of revenue in the United States. Of the 61 regional price discrimination markets within the United States, Armstrong on its own has foreclosed more than 20% of at least [REDACTED] of the markets in every year from 2013-2017, and has foreclosed 40% or more of [REDACTED] of the markets, depending on the year. Combined, Armstrong and USG have foreclosed at least [REDACTED]% of the market in [REDACTED] of the regional price discrimination markets within the United States, depending on the year. These high foreclosure shares are exacerbated by several factors, including the agreements’ long terms (on average 3 years), the fact that distributors cannot terminate them without cause, and the fact that foreclosed distributors are highly compliant with their restrictions on purchasing SACTs from rival manufacturers. Further, I present not only concrete examples of distributors being forced to stop selling Rockfon SACTs when they become foreclosed, but also statistical analysis of sales data showing that Rockfon grew significantly slower among foreclosed customers than among unforeclosed customers.

8. **D. Harm to Consumer Welfare and Lack of Offsetting Procompetitive Efficiencies.** Standard economics assumes a firm always tries to maximize its profits. Thus, standard economics would assume that the defendant Armstrong entered into exclusivity agreements in order to increase its profits, and the evidence suggests that its exclusivity agreements did in fact increase Armstrong's profits. But economists have also long recognized that many types of conduct that benefit a *firm* actually harm *consumers*. For example, burning down a rival's manufacturing plant would likely increase the arsonist's profits, but that would harm consumers by eliminating the rival product and allowing the arsonist to raise prices. In contrast, other types of conduct increase the firm's profits in a way that also benefits consumers. The most common example is conduct that allows the firm to increase its product quality (such as research and development) or reduce its prices (such as reducing the cost of making the product). One can use standard economic tools to determine whether a given type of conduct is anticompetitive—i.e., harms consumer welfare—or is procompetitive—i.e., benefits consumer welfare.

9. ***No Benefit to Consumer Welfare.*** Although exclusive dealing agreements can sometimes create procompetitive efficiencies that benefit consumers, here Armstrong's claims that its exclusive dealing is procompetitive do not hold up to scrutiny. For example, Armstrong has argued to the Court that its contracts assure distributors of stable supply, but Armstrong's distributor agreements actually explicitly give Armstrong the right to limit or discontinue its supply of SACTs at any time, without any notice or liability. Further, there are not even any *potential* procompetitive effects from Armstrong's agreements with distributors that prohibit branches that do not even carry the Armstrong SACT line from purchasing from Rockfon. I present this analysis in detail below in Part V.

10. ***Significant Anticompetitive Harm to Consumer Welfare.*** The foreclosure of rival SACT manufacturers, and Rockfon in particular, has anticompetitively harmed consumers in multiple ways. For example, the foreclosure slowed Rockfon's sales growth in North America, which in turn delayed when it became profit-maximizing for Rockfon to build a manufacturing plant in the United States. The lack of a domestic manufacturing plant impaired Rockfon's ability to compete in multiple ways, such as increasing its incremental costs, increasing lead times, and reducing demand for Rockfon SACTs in the U.S. All of these impairments to Rockfon's efficiency reduced the competitive constraint Rockfon imposed on Armstrong's prices, therefore allowing Armstrong to maintain supracompetitive prices.

11. Moreover, Armstrong and USG foreclosed access to the most efficient means of distribution, which further weakened the competitive constraint Rockfon imposed on Armstrong in regions where Rockfon had to turn to less efficient distributors. Indeed, Armstrong employees have expressed the belief, both in internal discussions with their colleagues and sworn deposition testimony, that giving Rockfon access to distribution in a region would cause market prices to decrease in that region.

12. The foreclosure of Rockfon (as opposed to other manufacturers) in particular had especially large anticompetitive effects because Rockfon is a market maverick. Rockfon's products are so unique that Armstrong had to develop "defensive" SACTs to compete against Rockfon. Armstrong's prices for these "defensive" SACTs are lower than its prices for its standard products, but Armstrong will not even offer these defensive SACTs to customers unless Armstrong is worried that they will lose a particular job to Rockfon. Therefore, when Armstrong's foreclosure of distributors prevents Rockfon from competing for a job, or hampers Rockfon's ability to compete for a job by foreclosing the most efficient distributors, customers do not even get the opportunity to buy Armstrong's less-expensive defensive products. Moreover, the evidence indicates that Rockfon prices more aggressively than USG or CertainTeed, meaning that foreclosing Rockfon allows Armstrong to compete only against higher-priced manufacturers, which consequently allows Armstrong to maintain higher prices. Indeed, Armstrong's contracts that specifically prohibit distributors from carrying Rockfon, but allow CertainTeed and USG, would be economically rational only if Armstrong believed that Rockfon imposed a unique (and stronger) competitive constraint on Armstrong's prices than CertainTeed or USG did.

13. In sum, Armstrong's exclusive dealing agreements increased its profits not by making Armstrong more efficient, reducing its prices, or increasing its quality, but instead by preventing customers from buying rival SACTs such as Rockfon's. USG's agreements further exacerbated this anticompetitive foreclosure.

14. **E. Damages.** The anticompetitive foreclosure created by Armstrong and USG's anticompetitive foreclosure caused Rockfon to lose profits from 2014-2018 of over \$[REDACTED] million. Armstrong's foreclosure alone damaged Rockfon by over \$18 million.

QUESTIONS ASKED

15. Plaintiff counsel has asked me to perform an economic analysis of the evidence in this case to answer the following questions about this alleged anticompetitive conduct:

- A. What are the relevant markets?
- B. Did Armstrong and USG have market or monopoly power in those markets?
- C. Did Armstrong and USG agreements foreclose rival SACT manufacturers such as Roxul?
- D. If there was foreclosure, did it anticompetitively harm consumers?
- E. If there was anticompetitive foreclosure, how much did it injure Roxul?

QUALIFICATIONS

16. I am the Petrie Professor of Law at Harvard University, where I teach and write about the economic analysis of antitrust law, health policy, and various other subjects. I am the author of various books, including *U.S. Antitrust Law & Economics*; co-author of *Global Antitrust Law & Economics*, *Global Competition Law & Economics*, and *Areeda, Elhauge & Hovenkamp, Vol X, Antitrust Law*; and editor of *The Research Handbook On The Economics Of Antitrust Law* and *The Fragmentation Of U.S. Health Care*. I am also the author of numerous articles on various topics involving the economic analysis of antitrust and other legal issues, including articles on the economics of exclusionary conduct. My CV (attached as Exhibit A.) lists all my publications, including all those in the past ten years. Exhibit B to this report describes my compensation and the cases in which I have testified at trial or in a deposition in the past four years. I am being compensated at a rate of \$1250 per hour for my work on this case, and my consulting firm, Legal Economics LLC, is being compensated \$235-575 per hour for the work of my staff on this report. None of my compensation in this case is contingent upon the outcome of the case or any aspect of the case.

17. I am also President of Legal Economics, LLC, which provides expert witnesses and support work on legal cases. I myself have testified as an expert witness on antitrust economics in dozens of federal cases, and I have been qualified as an expert in antitrust economics by all sixteen of the sixteen courts to rule on that question. I have also served as an expert witness on antitrust economics before Congress, arbitration panels, and competition agencies in the US, EC, Korea and Brazil. My testimony as an economics expert has spanned a wide range of topics, including mergers, horizontal agreements, vertical

agreements, monopolization and exclusionary conduct, price discrimination, health economics, patent economics, and contract economics. I have been an economics expert in several past cases involving exclusionary conduct. My clients have included leading corporations, law firms, and the United States. I have been named one of the world's leading competition economists in the *International Who's Who of Competition Lawyers and Economists*.

18. I am a Member of Advisory Boards for the Journal of Competition Law & Economics, the Social Sciences Research Network on Antitrust Law & Policy, and the Social Sciences Research Network on Telecommunications & Regulated Industries. I have taken courses in economics, statistics, antitrust, and economic analysis of law, and I regularly read and use economic literature on antitrust economics, including books on industrial organization. I also regularly attend workshops on those and other topics regarding the economic analysis of law. I routinely use and teach economic analysis in my classes, including those that I regularly offer on antitrust law and economics and health law policy.

I. SACT MARKET DEFINITION AND POWER

19. The relevant product market in this case is the market for Suspended Acoustical Ceiling Tiles (“SACTs”). SACTs are rectangular tiles made of materials that absorb sound and are installed onto the ceilings of buildings using complementary metal grids. The relevant geographic market is North America (consisting of the U.S. and Canada) because most of the foreclosure effects depend on total foreclosure throughout North America and cause harms that are felt by every customer throughout North America. For the Court’s convenience, I also calculate market shares and foreclosure shares for a market limited to the United States, given the Court’s ruling that its jurisdiction is limited to the United States. There are also regional subsets of the United States that can and have been charged different prices in a way that makes them relevant price discrimination markets within the broader geographic market. I define a set of 61 regional price discrimination markets within the United States based on evidence of successful price discrimination between them and of the inability of customers in higher-priced regions to escape those higher prices by substituting to lower-priced regions. Section A below defines the relevant markets, section B shows the competitors’ shares of those markets, and Section C shows that in those markets Armstrong has monopoly power and USG has market power.

A. Market Definition

1. The Relevant Product Market Is SACTs

20. **a. Methodology.** Antitrust economics generally defines the relevant market in the following two-step process.³ First, one ranks the products that are most similar to the defendant's products at issue, from the closest substitutes to the most distant.⁴ For example, in car markets, the closest substitute to one luxury sedan is another luxury sedan, the next closest substitute is probably a non-luxury sedan, and even more distant partial substitutes include motorcycles and bicycles.

21. Second, one starts with the smallest possible market that is potentially useful for analysis (in an exclusive dealing case, just the defendant's products at issue and their closest substitutes), and tests whether that posited market would likely pass the "Hypothetical Monopolist Test." The Hypothetical Monopolist Test asks whether a hypothetical 100% monopolist in a posited market could profitably charge prices that were at least 5% higher than the prices that would prevail if the market were competitive.⁵ If a hypothetical monopolist could, then the test is passed, meaning that the posited market is sufficiently broad (i.e., includes a sufficient number of substitutes) to be useful in economic analysis. If the test is failed, that tells the economist that the posited market is too narrow (i.e., includes an insufficient number of substitutes) to be useful in economic analysis. The posited market should then be expanded to include the next closest substitute, and then the hypothetical monopolist test should be repeated to see whether the slightly broader market is sufficiently broad.

³ The DOJ/FTC Horizontal Merger guidelines describe this methodology, among other commonly used market definition methodologies in economic analysis of antitrust issues. Although the government enforcement agencies most often apply this methodology to merger analysis, it is also applicable to exclusionary conduct cases. *See* Horizontal Merger Guidelines n. 5 (noting that market definition is similar for non-merger conduct, such as monopolization, except that one cannot assume that the prices that exist in the market are at competitive levels because the alleged anticompetitive conduct may have in fact already elevated them above competitive levels).

⁴ DOJ/FTC Horizontal Merger Guidelines §4.1.1 (2010) ("When applying the hypothetical monopolist test to define a market around a product offered by one of the merging firms, if the market includes a second product, the Agencies will normally also include a third product if that third product is a closer substitute to the first product than is the second product.").

⁵ *See* DOJ/FTC Horizontal Merger Guidelines §4 (2010) (describing the hypothetical monopolist test).

22. For example, suppose the defendant sold “hand-churned” chocolate ice cream. Suppose the closest substitute to the defendant’s product is another type of hand-churned chocolate ice cream, the next closest substitute is machine-churned chocolate ice cream, and the next closest is vanilla ice cream. Antitrust economics would start with the smallest possible market: just “hand-churned” chocolate ice cream, and ask whether it passed the Hypothetical Monopolist Test. A posited market for just “hand-churned” chocolate ice cream would probably fail the hypothetical monopolist test because so few people care about whether their ice cream is “hand-churned” that, if even a 100% monopolist in hand-churned chocolate ice cream tried to raise prices by 5% or more over the competitive level, so many customers would switch to machine-churned chocolate ice cream that the price increase would not be profitable. That tells the economist directly that impairing competition in just the hand-churned chocolate ice cream market could not significantly harm consumers, and thus that using a hand-churned ice cream market would not be useful for competition analysis. The economist’s next step would then be to add the next closest substitute to the market (machine-churned chocolate ice cream), and test whether this slightly broader market satisfied the hypothetical monopolist test. A posited market for “all chocolate ice cream” (both hand-churned and machine-churned) would probably pass the hypothetical monopolist test because many people have strong preferences for chocolate or vanilla ice cream, and consequently if a hypothetical 100% monopolist in chocolate ice cream raised prices by 5% above competitive levels, not enough customers would switch to vanilla ice cream to make the price increase unprofitable. This would directly indicate that impairing competition solely between chocolate ice cream suppliers could cause significant harm to consumers, and thus that a chocolate ice cream market is useful for competition analysis.

23. Markets defined using the hypothetical monopolist test usually “exclude some substitutes to which some customers might turn” in response to a price increase for the products in the relevant market.⁶ Economists generally

⁶ DOJ/FTC Horizontal Merger Guidelines §4 (2010) (“Market shares of different products in narrowly defined markets are more likely to capture the relative competitive significance of these products, and often more accurately reflect competition between close substitutes. As a result, properly defined antitrust markets often exclude some substitutes to which some customers might turn in the face of the price increase even if such substitutes provide alternatives for those customers.”); *id.* §4.1.1 (“Groups of products may satisfy the hypothetical monopolist test without including the full range of substitutes from which customers choose.”). Relatedly, official commentary to the Merger Guidelines explains that “Even when no readily apparent gap exists in the chain of substitutes, drawing a market boundary within the chain may be entirely appropriate when a hypothetical monopolist over just a segment of the

define markets narrowly to focus only on close substitutes because “defining a market broadly to include relatively distant product or geographic substitutes can lead to misleading market shares” that overstate the importance of distant substitutes.⁷ This means that the mere fact that some customers substitute between Products A and B does not necessarily mean that Products A and B are in the same market. Indeed, “The hypothetical monopolist test may identify a group of products as a relevant market even if customers would substitute significantly to products outside that group.”⁸

24. Rather, the percentage of customers who would switch to other products in response to a price increase of 5% or more must be sufficiently high that that price increase would not be profitable. For example, suppose a hypothetical monopolist in a posited market with a competitive price of \$100, cost of \$95/unit, and sales of 1000 units would lose 40% of customers to other markets if it raised prices by 5%. That price increase would still be profitable because profits with the price increase = $(\$105 - \$95)(.6)(1000) = \$6,000$, whereas profits at the competitive price were $(\$100 - \$95)(1000) = \$5,000$. Thus, it would be a relevant market even though a substantial percentage (40%) of customers would switch in response to a 5% price increase because that percentage is not sufficiently high to deter the price increase from occurring.

25. **b. Ranking Closest Product Substitutes.** As just described, the first step is to rank the substitutes for Armstrong’s SACTs from closest to most distant. In North America, Armstrong’s ceiling tiles are most commonly sold in either 2’-by-2’ or 2’-by-4’ rectangles and are installed onto metal ceiling grids with matching sized slots.⁹ SACTs are designed to serve customers who primarily need

chain of substitutes would raise prices significantly.” DOJ/FTC, Commentary on the Horizontal Merger Guidelines 15 (2006). The Merger Guidelines likewise explain that “relevant markets need not have precise metes and bounds.” DOJ/FTC Horizontal Merger Guidelines §4 (2010).

⁷ DOJ/FTC Horizontal Merger Guidelines §4 (2010) (“Defining a market broadly to include relatively distant product or geographic substitutes can lead to misleading market shares. This is because the competitive significance of distant substitutes is unlikely to be commensurate with their shares in a broad market. Although excluding more distant substitutes from the market inevitably understates their competitive significance to some degree, doing so often provides a more accurate indicator of the competitive effects of the merger than would the alternative of including them and overstating their competitive significance”).

⁸ DOJ/FTC Horizontal Merger Guidelines §4.1.1 (2010).

⁹ See Armstrong Suspended Ceiling Installation Guide (“The ceiling system is made up of Armstrong panels (either 2’ x 4’ or 2’ x 2’) which are supported by a suspension system (main beams, cross tees, and hangers), and perimeter molding”) *available at*

“functionality” (such as sound absorbency and fire resistance) at an affordable price, whereas more expensive specialty ceilings are designed to serve customers who demand a unique “design aesthetic” and are typically ten times as expensive as SACTs.¹⁰ SACTs are used primarily in commercial (as opposed to residential) buildings, and about 85% of commercial buildings are built with SACTs.¹¹

26. As described below, many types of evidence show that the closest substitutes for Armstrong’s SACTs are rival manufacturers’ SACTs, primarily because they provide a similar appearance and noise reduction level at a comparable price. The SACT market is differentiated, with higher quality (i.e., better noise reduction and cleaner appearance) SACTs being closer substitutes for each other than lower quality SACTs, and vice versa. After rival SACTs, the next closest substitutes for Armstrong’s SACTs are significantly more distant: drywall (which does not provide any noise reduction) and specialty ceilings made of metal or wood (which are much more expensive and are typically installed for style rather than noise reduction).¹² There is no need to rank more distant substitutes because the Hypothetical Monopolist test shows that a market limited to only SACTs is sufficiently broad, as shown below in Section c.

27. The primary attributes that make customers choose SACTs instead of other ceiling covers (such as drywall and metal ceilings) are SACTs’ combination

<https://www.armstrongceilings.com/pdbupimages-clg/198438.pdf/download/general-installation.pdf>.

¹⁰ May 21, 2014 Armstrong Analyst/Investor Day Transcript (“you can divide the world of ceilings into 2 buckets, acoustical tile, that’s what we call mineral fiber, that’s a large portion of our business; and specialty ceilings. Acoustical tile, the customer’s primary need is really around functionality and performance, could be acoustical performance, could be environmental or installation performance, it could be accessibility to the plenum. From an aesthetic perspective, they want it to look good, they want a nice clean look, but they really want it to blend into the space. It’s not mean to really stick out and stand out in the space. Architectural specialties . . . is . . . our name for the other customer need, which is really around creating a unique and different design aesthetic. It’s when the architect, the owner, they really want the ceiling to stick out. . . . the price points [of architectural specialty ceilings] tend to be a lot higher, so on average, on a unit price point basis, significantly over 10x that of acoustical tile. . . . If acoustical tile is the Volkswagen of our portfolio, [architectural specialty] is . . . the Lamborghini”).

¹¹ May 21, 2014 Armstrong Analyst/Investor Day Transcript (“in the U.S., about 85% of the commercial buildings have suspended ceilings.”).

¹² ROXUL_0102375 (2014 Market Report by Freedonia) at ROXUL_0102449 (some buildings are built with drywall ceiling covers or no coverage of the ceiling at all, which is called an “open plenum”); *infra* note 38 (collecting evidence that specialty ceilings are significantly more expensive than SACTs).

of: (i) noise reduction; (ii) appearance; (iii) access to the plenum; and (iv) price.¹³ No products besides rival manufacturers' SACTs provide these functions of Armstrong's SACTs at a similar price.

28. (i) *Noise Reduction*. SACTs are specifically designed to reduce sound in a space by absorbing (rather than reflecting) sound waves that reach the ceiling. A ceiling tile's ability to reduce sound can be measured quantitatively as its "Noise Reduction Coefficient" ("NRC"), which ranges from 0 (no sound reduction) to 1.0 (100% sound reduction).¹⁴ In some situations, customers also consider a ceiling tile's Ceiling Attenuation Class ("CAC"), which is instead a measure of how well the tile blocks sounds from outside of the room.¹⁵ The importance of noise reduction to SACT customers is supported by many types of evidence, including: (a) architect surveys, in which architects rank noise reduction as one of the most important characteristics of SACTs;¹⁶ (b) Armstrong and other manufacturers' promotional materials, which prominently feature the NRC rating of their SACTs;¹⁷ (c) price data, which shows that SACT customers are willing to pay

¹³ This is consistent with the testimony of Armstrong's Director of Pricing for ceiling tiles, who stated that "visual", "light reflectancy," and "acoustical performance" were the "primary" characteristics that determine which ones customers are willing to pay higher prices for. McKinney Deposition at 28.

¹⁴ See USG Acoustical Assemblies Brochure at 5 (defining "Noise Reduction Coefficient" as a "Measurement of the ability of a material such as an acoustical ceiling panel to absorb sound energy in the frequency range of 250 Hz to 2,000 Hz. High-NRC ceiling panels provide this type of sound control, which is important for large spaces such as open-plan offices.") *available at* http://www.usg.com/content/dam/USG_Marketing_Communications/united_states/product_promotional_materials/finished_assets/acoustical-assemblies-en-SA200.pdf.

¹⁵ Surveys indicate that architects are more familiar with NRC rating than CAC rating. ROXUL_0091965 at ROXUL_0092077 (2012 survey of 36 commercial architects stating that "Architects have only a nodding acquaintance with NRC and are almost totally ignorant about CAC."); *id.* at ROXUL_0092080 (architects typically rely on acoustical consultants to determine what NRC level to specify, and architects are "very inflexible when it comes to accepting close or equal substitutions on NRC or CAC ratings"). CAC measures "the decibel level required for audible sound transmission, with 25 decibels or below considered to be a poor CAC and 35 decibels or above considered to be good CAC performance." ROXUL_0102375 at ROXUL_0102441 (2014 ceiling industry report by Freedonia). Customers demand higher CACs on some projects but not others. AWI00041756 (November 2014 internal Armstrong email in which Full Line Sales Manager Zachary Thon states that "On a lot of projects walls go to deck so no CAC is needed").

¹⁶ See, e.g., ROXUL_5531594 at slide 16 (survey of architects listing the "Top Ranked Criteria" by far as "Surface Quality" and "Sound Absorption.")

¹⁷ See, e.g., Armstrong webpage for its Ultima family of SACT lines (its best-selling family); NRC always is the first-listed characteristic.

significantly more for SACTs with higher NRC levels;¹⁸ (d) deposition testimony;¹⁹ and (e) internal industry documents.²⁰

29. Armstrong's SACTs have NRCs ranging from 0.55 to 1.0.²¹ Rockfon's SACTs have a similar NRC range of 0.6 to 0.95.²² United States Gypsum ("USG"), the second-biggest SACT manufacturer in the United States, has SACTs with an NRC range of 0.55 to 0.9.²³ CertainTeed's SACTs have a comparable NRC range of 0.5 to 0.95.²⁴ In contrast, drywall has an NRC of only about 0.05.²⁵ Although some specialty ceilings made of metal or wood can have

<https://www.armstrongceilings.com/commercial/en-us/commercial-ceilings-walls/ceilings/ultima-ceiling-family.html>; USG webpage for "acoustical panels", which likewise lists the NRC as the first characteristic for all of USG's SACTs. <https://www.usg.com/content/usgcom/en/products-solutions/products/ceilings/acoustical-panels.html>.

¹⁸ See analysis below.

¹⁹ Loufek (AWI) Deposition at 33 ("Q: What functions of suspended acoustical ceiling tiles are most important to customers? A: First and foremost, it would be acoustics.").

²⁰ Hart Deposition Exhibit 4, Page 2 ("NRC (acoustics) is the key factor – reducing sound is the biggest consideration when selecting a ceiling").

²¹ Armstrong's cheapest SACT product line, the Cortega, has an NRC as low as 0.55. Armstrong Cortega Data Sheet, available at <https://www.armstrongceilings.com/pdbupimages-clg/216897.pdf/download/data-sheet-cortega-and-cortega-second-look.pdf> (accessed August 15, 2018). Armstrong's highest-NRC product line is its "Optima" ceiling tile, which has an NRC up to 1.0. <https://www.armstrongceilings.com/commercial/en-us/commercial-ceilings-walls/optima-lay-in-and-tegular-ceiling-tiles.html> (accessed August 15, 2018).

²² Rockfon's cheapest SACT line, the Pacific, has a minimum NRC of 0.6. http://www.rockfon.com/u/website_product/19379/Rockfon%C2%AE%20Pacific%E2%84%A2 (accessed August 15, 2018). Rockfon's highest-NRC SACT line, the Sonar, has a maximum NRC of 0.95. http://www.rockfon.com/u/website_product/19064/Rockfon%C2%AE (accessed August 15, 2018).

²³ USG's lower-end Fissured Basic Panels have NRCs have 0.55. <https://www.usg.com/content/usgcom/en/products-solutions/products/ceilings/acoustical-panels/usg-fissured-basic-acoustical-ceiling-panels.html> (Accessed August 16, 2018). USG's MARS SACTs have NRCs up to 0.9. <https://www.usg.com/content/usgcom/en/products-solutions/products/ceilings/acoustical-panels/usg-mars-high-nrc-high-cac-acoustical-ceiling-panels.html> (accessed August 16, 2018).

²⁴ CertainTeed Sand Micro ceiling tiles have a NRC of 0.5 www.certainteed.com/resources/CTC_Performa_Sand_Micro_DataPage.pdf (accessed August 19, 2018). CertainTeed Performa Open Plan ceiling tiles have a NRC as high as 0.95. [/www.certainteed.com/resources/CTC_Performa_Open_Plan_DataPage.pdf](http://www.certainteed.com/resources/CTC_Performa_Open_Plan_DataPage.pdf) (accessed August 19, 2018).

²⁵ <https://workingwalls.com/nrc-and-stc-what-are-they-whats-the-difference/> (accessed August 16, 2018) ("a painted drywall wall has NRC of about .05, so it absorbs only 5% of the sound").

NRC ratings as high as 0.9,²⁶ these specialty ceiling products are on average over 5-10 times more expensive than SACTs,²⁷ which makes customers unlikely to substitute from SACTs to specialty ceilings in response to a mere 5% increase in SACT prices.

30. Because manufacturers' various SACT product lines have different noise-reduction abilities, the SACT market is differentiated rather than homogenous. Customer surveys indicate that customers are generally willing to consider a SACT with an NRC within 0.10 of what the architect specifies.²⁸ This means, for example, that Armstrong's Optima product line (NRC of 0.9-1.0), competes much more closely with Rockfon's Sonar product line (NRC 0.7-0.95) than Rockfon's Pacific product line (NRC of 0.6).

31. Price data shows that customers are willing to pay significantly more for products with higher NRC levels.²⁹ For example, Rockfon's "Artic" and "Tropic" SACTs have different NRCs (0.75 for Artic and 0.85 for Tropic), but are otherwise almost identical (both have smooth white finishes, CACs of 22-23, the same fire grade performance, and similar light reflectance).³⁰ The 0.75 NRC Artic sells for on average \$0.62 per square foot, while the 0.85 NRC Tropic sells for \$0.79 per square foot, or 27% more.³¹ This directly indicates that customers are willing to pay significantly more for higher NRC products, especially because the average cost of producing these two SACTs is similar (\$0.46 per square foot for

²⁶ <https://www.armstrongceilings.com/commercial/en-us/commercial-ceilings-walls/woodworks-grille-ceiling-tiles.html>

²⁷ Barker Exhibit 4 (investment analysis of AWI by the firm SunTrust Robinson Humphrey, dated April 20, 2015) ("The [Architectural Specialties] business is composed of specialty ceilings systems which target design oriented projects. These projects are lower volume, but have a much higher price, which can be upwards of 5x to 10x the price versus acoustical tile.").

²⁸ ROXUL_0091965 (July 2012 Research Report on Ceiling Panels performed by the Moran Group for CMC. Moran interviewed 36 commercial architects about SACTs); *id.* at ROXUL_0092083 ("At 10 points, almost everyone who was asked rejected the idea that 10 NRC points was close enough to satisfy an or equal [specification]").

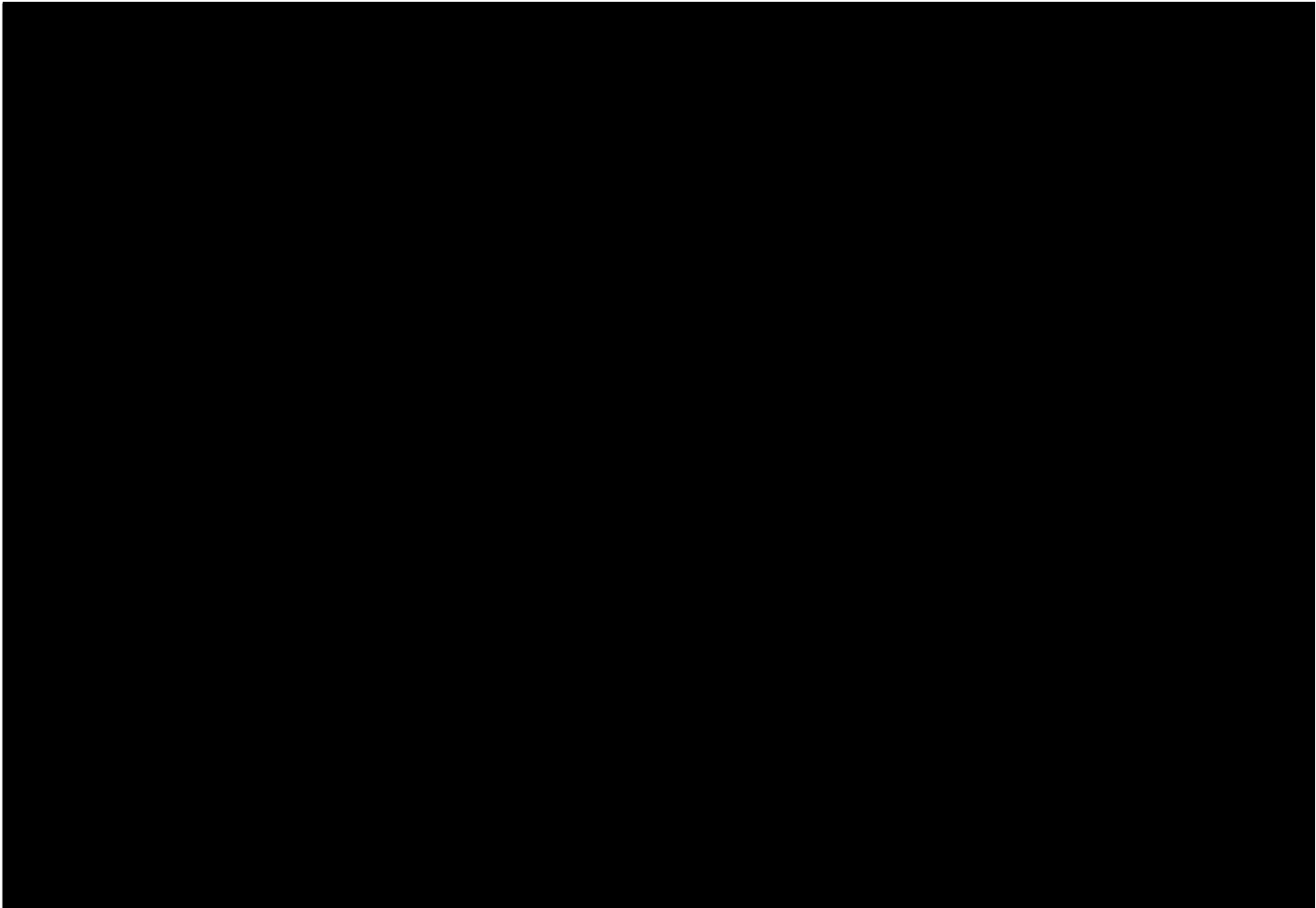
²⁹ This is best illustrated with Rockfon SACTs because Rockfon offers a range of SACTs that have identical appearances but different NRCs (in contrast, Armstrong's higher-NRC SACTs also tend to have superior appearances, which makes it more difficult to isolate the effect of NRC rating on price).

³⁰ See Rockfon's online description of its Artic SACT (http://www.rockfon.com/u/website_product/19392/ROCKFON%20Artic%C2%AE) and Rockfon's online description of its Tropic SACT (http://www.rockfon.com/u/website_product/58906/ROCKFON%20Tropic%C2%AE).

³¹ "ROXARM15 Rockfon SAP NRC and avg_price by prod_family.xlsx".

the Artic and \$0.49 per square foot for the Tropic),³² meaning that the higher price of the Tropic is due almost entirely to higher customer valuations of the Tropic as opposed to higher production costs.

32. More generally, Armstrong and Roxul sales data show that customers are willing to pay more for SACTs with higher NRCs. Figure 1 below shows the NRC and average price per square foot for Rockfon and Armstrong's best-selling SACTs. For both Rockfon and Armstrong, there is a strong positive relationship between price and NRC, meaning that customers are consistently willing to pay more for higher-NRC products.



³² "ROXARM15 Rockfon SAP NRC and avg_price by prod_family.xlsx".

³³ "ROXARM63 NRC vs Price 2016.png". Prices for both Armstrong and Roxul are limited to 2016 for an apples-to-apples comparison given that prices have changed over time. Chart is limited to SACT families that constituted at least 2% of the manufacturer's total SACT sales for readability.

33. *(ii) Appearance.* The evidence also indicates that customers value SACTs for their clean, unobtrusive appearance.³⁴ Both high-end and low-end SACTs are visually simple, rectangular monochromatic tiles that hide ductwork and electrical wires in the ceiling. In contrast to SACTs, which are meant to have unobtrusive appearances, specialty ceilings made of metal or wood are designed to draw attention to the ceiling.³⁵ Although drywall ceilings also provide a clean, unobtrusive appearance, drywall does not reduce sound the way SACTs do (see *(i)* above).

34. *(iii) Plenum Coverage and Access.* SACTs provide key advantages over other methods of sound reduction in buildings where the customer wants to both cover and provide easy access to the “plenum,” which in this context is the space between the ceiling tiles and the building’s structural ceiling. The plenum typically contains ductwork, electrical wires and lighting fixtures,³⁶ which most commercial customers wish to hide. SACTs can completely hide the plenum from view, unlike other materials that absorb sound, such as carpet, wall-mounted absorption panels, or “baffle” and “cloud” sound absorbers that are suspended from the ceiling on wires. Further, because SACTs are installed by simply laying them onto metal grids, building owners can easily access the plenum if necessary (for example, to perform maintenance on ductwork) by removing the ceiling tiles immediately below the plenum and putting the ceiling tiles back afterwards. In contrast, one cannot easily access the plenum if one instead simply covers the ceiling in drywall, which would require one to cut out drywall to access ductwork or wiring and then repair that drywall when finished.³⁷ Although the subset of specialty ceiling products that are installed in grids (similar to how SACTs are

³⁴ ROXUL_5531594 at slide 16 (survey of architects listing the “Top Ranked Criteria” by far as “Surface Quality” and “Sound Absorption.”).

³⁵ Pasquerello (AWI) July 13, 2018 Deposition at 20-21 (“Q: What’s the difference between sort of those specialty ceilings and the acoustical ceiling systems? A: Well substrate of course, you know, one’s wood, one’s metal. You know, obviously they’re visually different. And typically when an architect or designer decides to use a metal or wood ceiling they’re doing it more from a visual standpoint than performance standpoint. Although with wood and metal you can get acoustical properties as well. I mean it’s really --- comes down to a visual thing really with the metal and wood . . . with metal or wood they’re generally more expensive than your standard mineral fiber or fiber glass ceiling tile”).

³⁶ Lay (AWI) August 14, 2018 Deposition at 34 (“Q: I’m sorry, what’s the plenum? A: The stuff that’s above the ceiling, all the piping, all the HVAC . . . some ceilings are used primarily to cover . . . what’s there”).

³⁷ AWI01668922 at AWI01668929 (“Why Armstrong Ceilings vs. drywall? Accessibility to pipes, ductwork, and wiring”).

installed) also provide access to the plenum, they are significantly more expensive than SACTs, as described next.

35. (iv) *Price*. Rival manufacturers' SACTs are the only products that provide the combination of sound reduction, appearance, and plenum coverage and access at a price similar to Armstrong's SACTs. For example, although specialty ceilings can provide comparable noise reduction to Armstrong's SACTs, they are on average 5-10 times more expensive.³⁸ The significantly higher price of specialty ceilings means that they cannot impose a significant competitive constraint on SACT prices. On the other end of the spectrum, although drywall is significantly cheaper than SACTs, drywall provides such little sound absorption that it cannot be substituted for a SACT in any building where the architect specifies a sound-reducing ceiling material.

36. (v) *Strategic Business Documents Confirm that SACT Manufacturers View Rival SACTs as the Nearest Substitutes for their own SACTs*. Internal Armstrong documents confirm that Armstrong views rival SACT manufacturers' SACTs as the closest substitutes for Armstrong's SACTs. For example, a May 2017 internal Armstrong presentation listed only Rockfon, CertainTeed, and USG as its main ceilings competitors.³⁹ Similarly, a 2015 survey of brand awareness for ceiling tiles in the United States only listed USG, CertainTeed, and Chicago Metallic (Rockfon) as competitors.⁴⁰ Further, when Armstrong identifies the products that compete most closely with Armstrong's own SACTs, it always identifies SACTs from USG, Rockfon, or CertainTeed, rather than other types of sound-absorption products.⁴¹

³⁸ Barker Exhibit 4 (investment analysis of AWI by the firm SunTrust Robinson Humphrey, dated April 20, 2015) ("The [Architectural Specialties] business is composed of specialty ceilings systems which target design oriented projects. These projects are lower volume, but have a much higher price, which can be upwards of 5x to 10x the price versus acoustical tile."); Lay (AWI) August 14, 2018 Deposition at 32-33 ("Q: the specialty ceiling tile . . . Is it more expensive than . . . core? A: Absolutely . . . it is . . . A: It would be unusual to do a whole job out of the specialty ceilings. Q: Because of the cost? A: Yeah."); Loufek (AWI) Deposition at 21-22 ("Q: And what is that price difference generally [between mineral fiber tiles and wood or metal specialty ceiling tiles]? A: . . . square foot cost of ceilings, the tile only, nothing to do with suspension systems. Let's say those are around an average of [REDACTED] a foot. You can get up into the [REDACTED] with wood and metal. So there can be quite a difference.").

³⁹ AWI00226883 at AWI00226889.

⁴⁰ AWI01098716 at AWI01098717.

⁴¹ See, e.g., AWI00961128 at AWI00961137 (internal Armstrong document comparing the most similar Rockfon "competitive products" for Armstrong's SACTs. All the Armstrong

37. (vi) *Deposition Testimony.* Deposition testimony of Armstrong employees confirms that the closest substitutes for Armstrong's SACTs are the SACTs manufactured by USG, CertainTeed, and Rockfon. For example, Armstrong's Director of Pricing for its SACTs testified that the only competitors of "any significance" for Armstrong's suspended acoustical ceiling tiles were USG, CertainTeed, and Rockfon.⁴² Similarly, when asked which rival products are most similar in price and quality to Armstrong's best-selling SACT product lines, Armstrong employees have repeatedly listed SACTs manufactured by USG, CertainTeed, and Rockfon.⁴³

38. **c. Hypothetical Monopolist Test Confirms the Relevant Product Market Is SACTs.** The Hypothetical Monopolist test shows here that a market limited to only SACTs is sufficiently broad, and thus is a properly defined relevant market. As I explained above, a posited market is sufficiently broad under the Hypothetical Monopolist test if it would be profitable for a 100% monopolist in that market to raise prices by 5% or more above the competitive level. Whether such a price increase would be profitable depends on: (a) the competitive profit margin; and (b) the extent to which customers would switch to products outside the posited market in response to a price increase of 5% or more.

39. (i) *The Competitive Profit Margin in the SACT Market Is At Most 20%, Meaning that a 5% Price Increase Above Competitive Levels Would be Profitable Even If It Would Cause 20% of Customers to Substitute to Products Outside the Relevant Market.* The lower the profit margin is when the market is at a competitive level, the more likely a posited price increase is to be profitable, all

products listed are SACTs and all of the Rockfon products listed are SACTs); AWI00006662 at AWI00006671 (Armstrong document showing "price gap" between Armstrong SACTs and most comparable Rockfon products. The Rockfon products listed are all SACTs); AWI00226195 at AWI00226201 (Armstrong document identifying the competitor products most similar to Armstrong's Cortega, Dune, Ultima, and Optima SACTs. It lists only USG, CertainTeed, and Rockfon as competitors and every competitor product listed is a SACT).

⁴² McKinney (AWI Director of Pricing for Ceiling Tiles) Deposition at 18-19 ("Q: Who were the competitors in the suspended acoustical ceiling tile business in the United States? A: The – Armstrong, USG, CertainTeed, ROCKFON. And I'm not aware of anybody of any significance beyond that. Q: And you say any significance, you mean no one else that has probably even a one percent market share? A. Correct.").

⁴³ See, e.g. Harold Barker (AWI) Deposition at 213 (stating that USG's "Mars" ceiling tiles are the most comparable USG offering to Armstrong's "Ultima" tiles); Loufek (AWI) Deposition (listing the USG, CertainTeed, and Rockfon SACT product lines most similar to Armstrong's most popular SACT product lines).

else equal. This is because, when the profit margin is relatively low, a monopolist that raises its price does not lose as much profit on the sales it loses due to customers substituting to products outside the market.⁴⁴ For example, if the competitive profit margin was only 1%, then a 5% price increase would be unprofitable only if the monopolist lost more than 83% of its customers in response,⁴⁵ whereas if the competitive profit margin was 99%, then a 5% price increase would be unprofitable even if the monopolist lost only 5% of its customers.⁴⁶

40. Here, the best indicator of the competitive profit margin in the SACT market is Rockfon's profit margin. Profit margin data in this case is available only from Rockfon and Armstrong. Rockfon's profit margin is a good indicator of the competitive profit margin because its market share is too low (at most 2% in the U.S.) for Rockfon to exercise significant market power. In contrast, Armstrong already exercises significant market power with its dominant market shares (in excess of 50% in North America, the U.S., and most regions within the U.S.), and consequently currently has supracompetitive profit margins.⁴⁷

41. Rockfon's average profit margin on incremental sales of SACTs is at most 20%.⁴⁸ Assuming the competitive incremental profit margin is 20%, then it would be profitable for a hypothetical 100% monopolist in the domestic SACT market to raise prices 5% above the competitive level so long as less than 20% of customers substituted outside of the market in response.⁴⁹

42. *(ii) Few Customers Would Substitute Away From SACTs in Response to a 5% Increase Above Competitive Levels.* Multiple types of evidence indicate

⁴⁴ DOJ/FTC Horizontal Merger Guidelines §4.1.3 (2010) ("The hypothetical monopolist's incentive to raise prices depends both on the extent to which customers would likely substitute away from the products in the candidate market in response to such a price increase and on the profit margins earned on those products."). Put mathematically, the critical loss (maximum percentage decrease in quantity in response to a 5% price increase that would still be profitable) is $.05/ (.05+m)$, where m is the competitive profit margin.

⁴⁵ With a 1% competitive profit margin, the critical loss is $0.05/(0.05+0.01) = 83\%$.

⁴⁶ With a 99% competitive profit margin, the critical loss is $0.05/(0.05+.99) = 4.8\%$

⁴⁷ See *infra* Part I.C.2, showing that Armstrong has been able to raise its prices above its costs significantly more than Rockfon.

⁴⁸ See *infra* Part VI.B.

⁴⁹ With a 20% competitive profit margin, the critical loss is $.05/ (.05+.20) = 20\%$.

that fewer than 20% of customers would substitute to products besides SACTs if SACT prices increased by 5% above competitive levels.⁵⁰

43. 1. Unavailability of Products that Provide Similar Functions at a Similar Price.⁵¹ Few customers would substitute away from SACTs in response to a 5% increase above competitive levels because no other products provide similar functions at a similar price. Although drywall is cheaper than SACTs, its NRC (0.05) is so much lower than the least expensive SACT's NRC (0.50), that architects would not consider drywall to be a viable substitute for SACTs in any building that required noise reduction.⁵² Conversely, although specialty ceilings made of wood or metal ceilings can provide noise reduction that rivals the highest-quality SACTs, those specialty ceilings are so much more expensive than specialty SACTs (5-10 times more) that SACTs would still be a significantly more economical option even if their prices increased by 5% above competitive levels. And although baffles, islands, and other materials can absorb sound, none of these other products simultaneously provide easy access to, and coverage of, the plenum.

44. Further, most SACTs are purchased for "repair-and-replace" jobs in which the customer is repairing or replacing old SACTs that were previously installed in the building.⁵³ For these repair-and-replace jobs, there is no substitute for SACTs because only SACTs will fit in the existing metal grid and provide a consistent appearance if the customer is replacing some SACTs but not all of them. Consequently, for the repair-and-replace jobs that constitute the majority of SACT demand, few-to-no customers would substitute from SACTs to some other product.

45. 2. Specification Process Confirms Lack of Substitutability between SACTs and Other Ceiling Materials or Sound Absorption Products. Architects of a

⁵⁰ The Merger Guidelines advise that economists "take into account any reasonably available and reliable evidence" in "considering customers' likely responses to higher prices." The Guidelines acknowledge that "even when the evidence necessary to perform the hypothetical monopolist test quantitatively is not available, the conceptual framework of the test provides a useful methodological tool for gathering and analyzing evident pertinent to customer substitution and market definition." DOJ/FTC Horizontal Merger Guidelines §4.1.3.

⁵¹ This evidence of "objective information about product characteristics and the costs of delays of switching products, especially switching from products in the candidate market to products outside the candidate market," is one of the standard types of evidence that the Horizontal Merger Guidelines recommend economists use when implementing the Hypothetical Monopolist Test. See DOJ/FTC Horizontal Merger Guidelines §4.1.3 (2010).

⁵² See *supra* Part I.A.2, showing that architects generally require a SACT to have an NRC within 0.1 of what is required in the space and that comparing NRCs of various products.

⁵³ See *infra* Part I.C.1.

new building specify in their plans that the building be constructed with a particular set of SACTs. Generally, any architect might specify: (1) a particular brand and product line (e.g., “Armstrong Optima only”); (2) a particular brand and product line “or equivalent”; (3) multiple brands and product lines; or (4) multiple brands and product lines “or equivalent.”⁵⁴ These specifications directly show the products that architects view as reasonably interchangeable substitutes for Armstrong’s SACTs.

46. Surveys of architects show that architects believe that a SACT must have an NRC level that was less than 0.1 different to satisfy an “or equal” specification.⁵⁵ Further, architect specifications generally require contractors specifically to use SACTs as opposed to other products. For example, a specification for the Hult International Business School in Cambridge, MA has a section devoted specifically to “Acoustical Panels,” in which it lists multiple areas of the building that contractor must use SACTs on.⁵⁶ This specification requires not only that the contractor use SACTs for these portions of the building, but also that the particular SACTs used be from particular manufacturers (here, Armstrong, USG or CertainTeed), have a minimum NRC of 0.8, minimum CAC of 35, and minimum light reflectance of 0.80 for certain parts of the building.⁵⁷ Every other specification I have seen similarly requires specifically that a contractor use SACTs for particular portions of the building.⁵⁸ Thus, architectural specifications

⁵⁴ AWI00557081 (Armstrong document indicating how Armstrong rates specifications, from 1-5, based on how favorable they are to Armstrong. A spec rating of 5 means that “Armstrong is the basis of design” and “no competitive manufacturers, product names, or item numbers are listed anywhere in the spec.” A spec rating of 4 means Armstrong is the basis of design, but lists competitive manufacturers or includes the phrase “or approved equal”. A spec rating of 3 includes Armstrong, but one manufacturer is not favored over another in the specification. A spec rating of 2 means a competitor to Armstrong is the basis of design but Armstrong is listed as an acceptable manufacturer. A spec rating of 1 means the specification does not even mention Armstrong as an acceptable manufacturer).

⁵⁵ ROXUL_0091965 (July 2012 Research Report on Ceiling Panels performed by the Moran Group for CMC. Moran interviewed 36 commercial architects about SACTs); *id.* at ROXUL_0092083 (“At 10 points, almost everyone who was asked rejected the idea that 10 NRC points was close enough to satisfy an or equal [specification]”).

⁵⁶ AWI00557081.

⁵⁷ *Id.*

⁵⁸ *See, e.g.*, AWI00603315 at AWI00603319 (acoustical ceiling specification for James F Peebles Elementary School in Bourne, MA. It states “Manufacturers: available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following or equal: 1. Armstrong World Industries, Inc., 2. CertainTeed Corp. 3. USG Interiors”. The specification lists different particular acoustical tile characteristics for different parts of the building. For example, in “Classrooms and Corridors” it states that the NRC should be 0.70 and

prohibit contractors from substituting from SACTs to other products, which means that there would be little-to-no substitution from SACTs to other products if a hypothetical 100% SACT monopolist increased prices by 5% above competitive levels.

47. 3. Deposition Testimony Confirms that More Distant Substitutes Such as Drywall and Specialty Ceilings Do Not Constrain Armstrong's SACT Prices. The deposition testimony of Armstrong's director of pricing for ceiling tiles confirms that Armstrong's SACT prices are not constrained by products outside of the relevant market such as drywall and specialty ceilings. Armstrong's director of pricing for ceiling tiles [REDACTED]

⁵⁹ He testified that he [REDACTED]

⁶⁰ Similarly, he testified that Armstrong has reduced its SACT prices [REDACTED]

⁶¹ This deposition testimony confirms that rival SACTs constrain Armstrong's SACT prices in a way that products outside of the relevant market do not, and therefore that it is proper to define a relevant product market limited to only SACTs.

48. 4. Armstrong, A Real Sub-100% Monopolist, Has Been Able to Profitably Charge Prices 5% Above Competitive Levels. Here, evidence that Armstrong [REDACTED] above Rockfon for comparable SACTs directly shows that a hypothetical 100% monopolist in SACTs would be able to elevate SACT prices 5% above competitive levels. This logic follows because: (a) Rockfon's prices are accurate measures of prices at the competitive level because Rockfon lacks market power; and (b) a hypothetical

the CAC should be "minimum 35" and the basis of design product is the Armstrong Ultima, whereas in the special education "SPED" area, the minimum NRC is 0.95, and the basis of design product is the Armstrong Optima); AWI00517018 (specification with Rockfon and USG as the basis of design, and Armstrong and CertainTeed as permitted substitutions. The "NRC range" is listed as 0.75).

⁵⁹ McKinney Deposition at 12-13.

⁶⁰ [REDACTED]

⁶¹ [REDACTED]

100% monopolist would have even more market power than Armstrong (a sub-100% monopolist), so if Armstrong can raise prices at least 5% above the competitive level, then so could a hypothetical 100% monopolist. I show below in Part C.2 that multiple types of evidence indicate that Armstrong [REDACTED] [REDACTED] Rockfon's prices for similar products. For example, I show below that Armstrong charges a [REDACTED] higher price for its Optima SACT than Rockfon charges for its Sonar SACT, even though both have the exact same NRC, similar textures, and similar CACs.⁶² I also show that Armstrong charges a [REDACTED] higher price for its Ultima SACT than Rockfon charges for its Alaska dB SACT, even though both products have the same CAC and Rockfon's Alaska dB actually has a higher NRC.⁶³ Further, I show that my calculations are consistent with Armstrong's internal estimates that its prices were at a [REDACTED] premium over Rockfon, depending on the product.⁶⁴ In sum, Armstrong [REDACTED] [REDACTED] so a hypothetical 100% monopolist would necessarily be able to as well. This directly shows that a product market for SACTs is sufficiently broad.

2. The Relevant Geographic Market Is North America and Within the United States There are Relevant Regional Price Discrimination Markets.

49. **a. The Relevant Geographic Market Is North American (U.S. and Canada) Market For Most Foreclosure Effects.** As I show below, each of the regional price discrimination markets within the United States is sufficiently broad to pass the Hypothetical Monopolist Test. Thus, by definition a geographic market limited to North America is also sufficiently broad to pass the Hypothetical Monopolist test. Consequently, Armstrong's high market shares in North America indicate that Armstrong has market power and monopoly power over buyers in North America, given the high barriers to entry and expansion throughout North America, described below in Part C.1.

50. Also confirming this geographic market definition is the fact that SACTs designed for other regions of the world will not physically fit in North American grids because they are different sizes than North American SACTs.⁶⁵

⁶² See *infra* Table 6.

⁶³ See *infra* Table 7.

⁶⁴ See *infra* Table 8.

⁶⁵ In the U.S. and Canada, SACTs are typically 2x2 ft or 2x4 ft rectangles, and in the grids in which they are installed have slots of the same size. See Armstrong Instructions for Installing Suspended Ceilings ("The ceiling system is made up of Armstrong panels (either 2' x 4' or 2' x 2') which are supported by a suspension system (main beams, cross tees and hangers),

Further, SACTs designed for other regions of the world typically have different certifications than what North American customers demand and are familiar with.⁶⁶

51. The relevant geographic market used for the purposes of calculating market shares, which are used to infer market power, can sometimes differ from the relevant geographic markets that are relevant for the purposes of calculating foreclosure shares, which are used to infer anticompetitive effects.⁶⁷ In this case, the foreclosed share of all SACT sales in North America (the U.S. and Canada) is relevant because multiple types of anticompetitive harm depend on the foreclosed share of all potential sales Rockfon could make in North America. As I show below in Part VII, the evidence shows that foreclosing Rockfon throughout North America slowed Rockfon's sales growth in North America, which in turn delayed

and perimeter molding”), available at <https://www.armstrongceilings.com/pdbupimages-clg/198438.pdf/download/general-installation.pdf>. In contrast, in Europe SACTs are typically in standardized metric dimensions (for example 600x600mm), and therefore a SACT designed for the European market will not physically fit in a North American grid. *See* Armstrong European Ceilings Overview at 41 (showing the standard European tile sizes of 600 x 600mm and 600 x 1200m), available at www.armstrongceilings.com/assets/global/commclgeu/files/Literature/166.PDF. 600mm is equivalent to 1.9685 feet, meaning that European 600 x 600m tile would be slightly too small to install in an North American grid designed for 2x2' tiles.

⁶⁶ For example, in the U.S. and Canada the primary measure of noise reduction customers use to compare SACTs is the “Noise Reduction Coefficient” (“NRC”), which is officially measured by the standard-setting organization ASTM as test number C432-09a. In contrast, in Europe the law requires that suspended ceiling suppliers provide a measure of noise reduction called the “Weighted sound absorption coefficient” or “Alpha-W” for short, which is measured differently than NRC. Two of the main differences between the NRC test and the Alpha-W test are: (1) the two tests are performed with ceilings at different heights; and (2) the NRC equally weights the measured sound absorption across the 250-2000Hz frequency range, whereas the Alpha-W weights the measured sound absorption across a broader 125-400Hz frequency range and more heavily weights the more commonly-emitted frequencies. *See* exp.rockfon.com/performance/acoustics/how+to+compare+ceiling+acoustics/sound+absorption+indicators (accessed August 17, 2018); Medio (Rockfon President) Deposition at 51 (“Q: And what worldwide product differences prohibit the purchase of ceiling tile from outside the United States? A: Again, from the standpoint of a – of an end user or contractor, if you don’t buy a product that’s specifically manufactured for the U.S. market, it could be different sizes, could be different materials, could be subject to different regulatory approvals, any number of differences.”); Kirby Williams (Roxul) Deposition at 62 (testifying that Rockfon developed a unique binder to use when manufacturing SACTs sold in the North America that would not contain formaldehyde, unlike the binders used in SACTs designed for European markets).

⁶⁷ EINER ELHAUGE, U.S. ANTITRUST LAW & ECONOMICS 399-400 (3d ed. 2018) (explaining that the relevant geographic market for calculating foreclosure shares depends on the theory of anticompetitive harm being tested).

when it became profit-maximizing for Rockfon to build and open its North American SACT manufacturing plant. Part IV.A demonstrates that delaying Rockfon's domestic manufacturing plant impaired Rockfon's ability to compete and constrain Armstrong's prices in multiple ways, including: (1) increasing the incremental cost to Rockfon of obtaining SACTs; (2) increasing Rockfon's lead times; and (3) reducing demand for Rockfon's products in the U.S. Economic theory and internal Rockfon documents both show that the date on which it becomes profit-maximizing to build and open the domestic manufacturing plant depends on the growth in Rockfon's total North American sales, which makes North America the relevant geographic market for inferring these types of anticompetitive harm from foreclosure shares. As I further show in Part IV.B, North America foreclosure also reduced Rockfon's North American sales in a way that deprived it of economies of scale in running its North American manufacturing plant.

52. **b. U.S. Shares Also Presented.** I understand that the Court has limited its jurisdiction in this case to only the United States. This jurisdictional limit does not alter the economic relevance of the North American market, because the ability to impose anticompetitive effects in the United States depends on the foreclosure share throughout North America. However, in case it is legally relevant or otherwise convenient to the Court, I also present market shares and foreclosure shares limited to the United States. All my damages calculations in Part VI are also limited to damages caused within the United States.

53. Although foreclosure effects depend on the foreclosure share throughout North America, the United States could also be sustained as a relevant geographic market. Because (as shown below) each of the regional markets within the United States is sufficiently broad to pass the Hypothetical Monopolist Test, by definition a geographic market limited to the United States is also sufficiently broad to pass the Hypothetical Monopolist Test. Indeed, regression analysis shows that Armstrong charges █% higher prices in the United States than in Canada for the exact same products, and that this difference is highly statistically significant.⁶⁸

⁶⁸ See "ROXARM84 US v Canada AWI Price Regression.txt." The regression specification is $\ln(\text{price}) = b_0 + b_1 \cdot \text{inUS} + b_2 \cdot \text{ContractorDistributor} + a_y + a_p$. Each transaction is a separate observation, and the regression dataset includes only Armstrong SACT sales within the U.S. and Canada. The variable *inUS* equals 1 for sales to the U.S. and 0 for sales to Canada. The variable *ContractorDistributor* equals 1 for customers that are contractors or distributors (who tend to receive lower prices) and 0 for all other customers. The term a_y represents yearly fixed effects and the term a_p represents product fixed effects. The regression estimated the

This directly confirms that a real sub-100% monopolist in the United States is able to profitably charge prices that are 5% higher than its prices in Canada without so many customers substituting to Canada so as to make the price difference unprofitable. Because a market limited to the U.S. passes the Hypothetical Monopolist Test, Armstrong's high market shares in the United States indicate that Armstrong has market power in the United States, given the high barriers to entry and expansion in the U.S. described below in Part C.1.

54. **c. There Are 61 Regional Price Discrimination Markets within the United States.** As the U.S. Merger Guidelines provide, subsets of customers within a product or geographic market can be defined as a relevant price discrimination market if a hypothetical monopolist could sustain price discrimination between them.⁶⁹ For geographic markets, "In the absence of price discrimination based on customer location, the Agencies normally define geographic markets based on the locations of suppliers, as explained in subsection 4.2.1. In other cases, notably if price discrimination based on customer location is feasible as is often the case when delivered pricing is commonly used in the industry, the Agencies may define geographic markets based on the locations of customers, as explained in subsection 4.2.2."⁷⁰ Subsection 4.2.2 further explains: "When the hypothetical monopolist could discriminate based on customer location, the Agencies may define geographic markets based on the locations of targeted customers. . . . Geographic markets of this type encompass the region into which the sales are made. Competitors in the market are firms that sell to customers in the specified region. . . . A region forms a relevant geographic market if this price increase would not be defeated by substitution away from the relevant product or by arbitrage, e.g., customers in the region travelling outside it to purchase the relevant product. . . . When the geographic market is defined based on customer locations, sales made to those customers are counted, regardless of the location of the supplier making those sales."⁷¹

55. As detailed below, the evidence here shows both that Armstrong does successfully price discriminate among customers in 61 different regions within the United States and that this price discrimination cannot be successfully defeated by arbitrage, such as customers buying SACTs from lower priced regions. Each of

coefficient on the inUS variable to be [REDACTED], which indicates that prices in the U.S. are [REDACTED]% higher ($e^{(0.078)}-1$).

⁶⁹ DOJ/FTC Horizontal Merger Guidelines §§ 4.1.4, 4.2.2 (2010).

⁷⁰ *Id.* §4.2.

⁷¹ *Id.* §4.2.2.

these 61 regions is thus a relevant geographic price discrimination market because impairing competition within that region would allow a hypothetical 100% monopolist in that region to raise prices at least 5% without so many customers substituting to suppliers in other regions so as to make that price increase unprofitable. For example, impairing SACT competition in New York but not Los Angeles would cause SACT prices to be supracompetitively elevated in New York but not Los Angeles.⁷² Defining multiple regional price discrimination markets within the U.S. is consistent with Armstrong's previous allegations in its litigation against the distributor CEMEX, in which Armstrong alleged that "the markets for ceiling products vary across different geographic regions."⁷³ I limit my consideration to regional price discrimination markets in the United States because the Court has held its jurisdiction is limited to the United States, so that only harm to regional markets in the United States is relevant, and because the evidence shows that Canadian regional markets are distinct from U.S. regional markets.

56. The 61 regional price discrimination markets in the United States that are relevant for calculating regional market shares are also relevant for calculating foreclosure shares, because some of the anticompetitive effects of Armstrong's conduct depend on foreclosure shares in these regions. For example, one anticompetitive harm in this case comes from Armstrong foreclosing Rockfon from access to the most efficient distributors in a region, thereby allowing Armstrong to elevate prices in that region without any competitive constraint from Rockfon. For this theory of anticompetitive harm, the relevant geographic market is the regional price discrimination market over which Armstrong can elevate prices if it restrains competition from Rockfon.⁷⁴ Put another way, the relevant geographic market for this theory of anticompetitive harm is the region because substantially foreclosing Rockfon in New York but not Los Angeles would cause this particular anticompetitive harm only in New York. I discuss this theory of anticompetitive harm more below in Part IV.C, where I show that Armstrong's foreclosing conduct did indeed substantially foreclose Rockfon from most regional

⁷² To be clear, it is possible for competition in Los Angeles to be impaired even if there is no foreclosure in Los Angeles because aggregate foreclosure of North America can impair rival efficiency in a way that impairs the rival's ability to compete in all regions within the United States, for example if the North American foreclosure increased the rival's cost of acquiring SACTs.

⁷³ AWI Second Amended Counter Claims ¶21, in *Cemex v. Armstrong*, Case No 3:16-cv-00186.

⁷⁴ EINER ELHAUGE, *U.S. ANTITRUST LAW & ECONOMICS* 399-400 (3d ed. 2018) ("If instead the anticompetitive theory were that the exclusive dealing effectively created a local cartel or monopoly . . . then the relevant market might instead be the local . . . market").

markets and therefore allowed Armstrong to maintain supracompetitive prices there. This foreclosure of Rockfon in particular is especially harmful because Rockfon is a “maverick” firm whose aggressive prices and innovative products provide a unique competitive constraint on Armstrong, as discussed below in Part I.D.

57. (i) *Armstrong’s Prices Vary Significantly Between Regions of the United States.* Prices of the exact same SACT products vary significantly (well over 5%) between different regions within the United States. For example, Armstrong employees have testified in depositions that Armstrong charges significantly higher prices for the same products in New York City than in Florida.⁷⁵ Armstrong assigns each of its distributors in the United States to one of 61 “Pricing Metros.”⁷⁶ Each Pricing Metro has a unique set of list prices.⁷⁷ It would be economically irrational for Armstrong to repeatedly incur the administrative costs of defining different pricing metros setting unique list prices in each metro every year if customers could evade Armstrong’s prices in the higher-priced metros by substituting to Armstrong’s lower-priced metros.⁷⁸ Thus, these “Pricing Metros” that Armstrong defined directly show the areas over which

⁷⁵ See, e.g. Pasquerello (AWI) July 13, 2018 Deposition at 58.

⁷⁶ Armstrong data indicates that it currently uses 61 pricing metros in the United States and 5 in Canada. “ROXARM65 awi unique price metros.txt”.

⁷⁷ McKinney (AWI Director of Pricing for Ceiling Tiles) Deposition at 63 (“Q: . . . does Armstrong set different list prices for different regions in the United States? A: We set them for different pricing metros.”) Data Armstrong has produced indicates that Armstrong also has distinct pricing metros for regions outside of the United States and Canada, such as Mexico and the rest of Latin America. See AWI01709740 (listing Armstrong pricing metros). The “list price” for a product is the default price Armstrong charges the customer for that product if there are no discounts applied to the product. McKinney Deposition at 41 (“The list price would be the published price for a metro – pricing metro. So a geography. At which that product is available to our distributors or direct contractors to purchase without any intervention or price exception”).

⁷⁸ McKinney (AWI Director of Pricing) Deposition at 43 (“

”); *id.* at 44 (“

Armstrong believes it can charge distinct prices without many customers substituting to lower-priced regions.⁷⁹

58. Based on the locations of the customers that Armstrong has assigned to each Pricing Metro, I have created a geographic map that indicates the closest Armstrong Pricing Metro for each postal code within the United States.⁸⁰

⁷⁹ Armstrong's Director of Pricing explained that one of the reasons Armstrong is able to define different list prices for different Price Metros is because contractors are not willing to travel far to do work. McKinney (AWI Director of Pricing) Deposition at 64-65 ("Q: Why does Armstrong set different list prices for 62 different regions in the U.S.? A: . . . construction is still a local and regional activity. Contractors . . . the vast majority of them don't travel hundreds of miles to do work. So they're centered around certain areas. And even in, you know, Eastern PA and PA-Jersey, this contractor works this area, this contractor works this area. No one covers the whole area. So there's certainly a variation in building material prices across geographies").

⁸⁰ For zip codes that do not contain any customers that Armstrong assigned to a Pricing Metro, I determined the relevant Pricing Metro that would apply by calculating the nearest customer location to that zip code with an assigned Pricing Metro. Because Armstrong's pricing metros are also often defined by state (for example, there is a "North Carolina" pricing metro and a "Utah" pricing metro), I considered a zip code as part of a particular Pricing Metro only if that zip code was in a state that one of the Armstrong customers assigned to that Pricing Metro was in.

Figure 2:

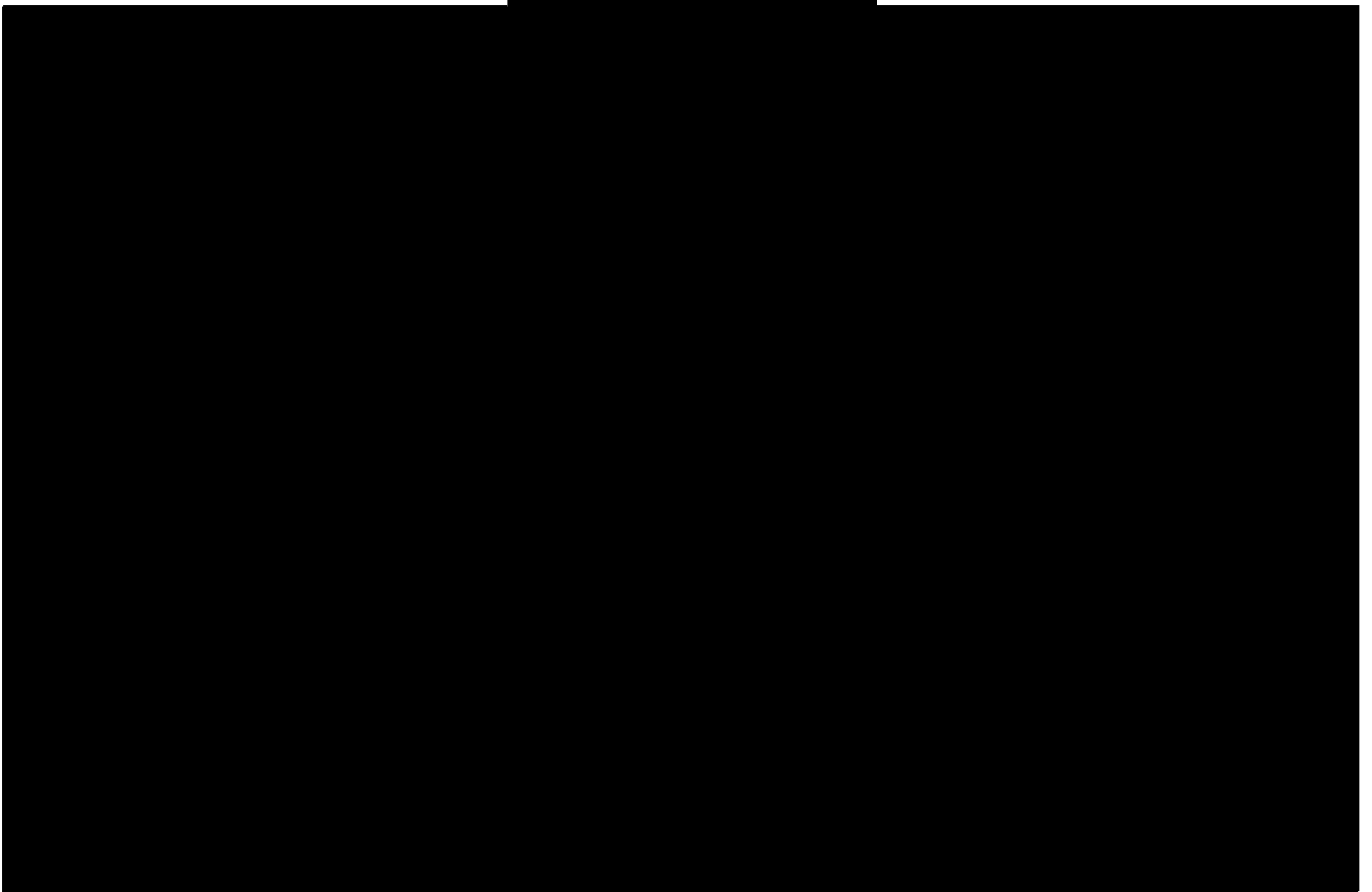


59. Armstrong's sales data confirms that it charges significantly higher prices in New York City than in Florida for the same products. Figure 3 below shows the list price and average net price for Armstrong's best-selling product ([REDACTED]) in the New York City pricing metro and the North Central Florida pricing metro. It shows that Armstrong's net prices have been [REDACTED]% higher in New York than in North Central Florida, and that its list prices have been [REDACTED]% higher in New York than in North Central Florida.⁸² The fact that Armstrong, a real firm with a market share below 100%, can profitably charge prices that are well more than 5% higher in some regions of the United States than in others directly shows that a hypothetical 100% monopolist could profitably raise prices 5% above the competitive level in certain regions of the United States, and thus that it is appropriate to define regional markets that are smaller than the United States as a whole.

⁸¹ "USA.jpg"

⁸² "ROXARM82 NYC v NCF list net premiums.csv."

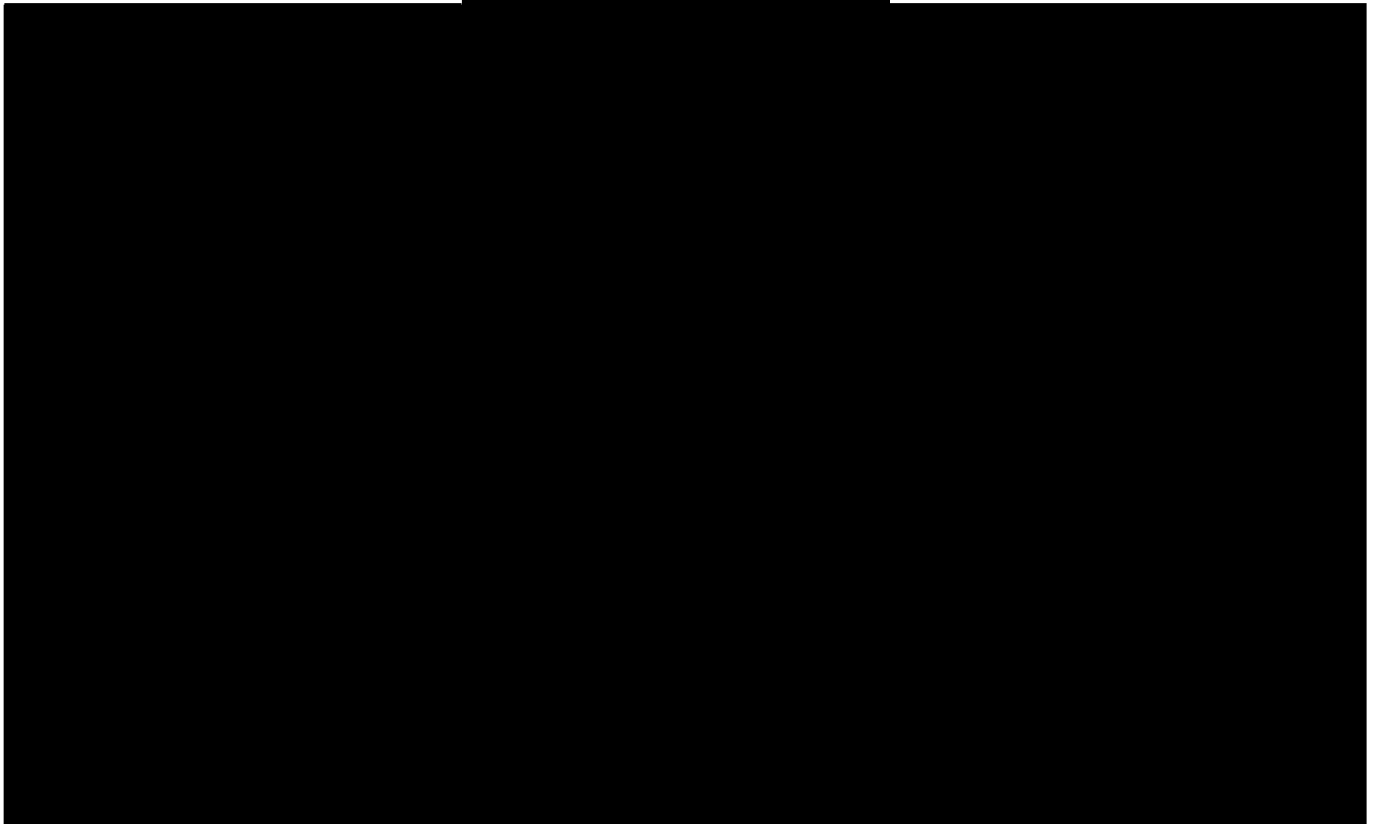
Figure 3



60. More generally, Figure 4 below shows the variation in the average net selling price of this same Armstrong product () between Armstrong's various pricing metros in each year from 2011 to 2017 (each diamond represents a distinct pricing metro).

⁸³ "ROXARM82 NYC v NCF list net premiums.csv".

Figure 4:



61. This phenomenon of significant variation in Armstrong prices between Pricing Metros is not unique to particular products; Armstrong sales data shows that its SACT prices generally vary significantly within regions of the United States. One can simultaneously measure variation in the prices of all of Armstrong's various SACT products across regions by calculating the Fisher price index of each region within the United States. In short, the Fisher price index uses price information on all of Armstrong's SACT products but controls for the mix of Armstrong's SACT products over time and across regions. Therefore, differences in the Fisher price index between regions will be due only to Armstrong charging different prices for the same products between regions, rather than differences in product mix between regions. Figure 5 below shows the variation in the Fisher price index of Armstrong's SACTs between Pricing Metros, in particular showing the maximum, 75th percentile, 50th percentile (median), 25th percentile, and minimum value in each year. It confirms that

[REDACTED]

⁸⁴ "ROXARM82 price variation BP1912A.csv".

Figure 5:

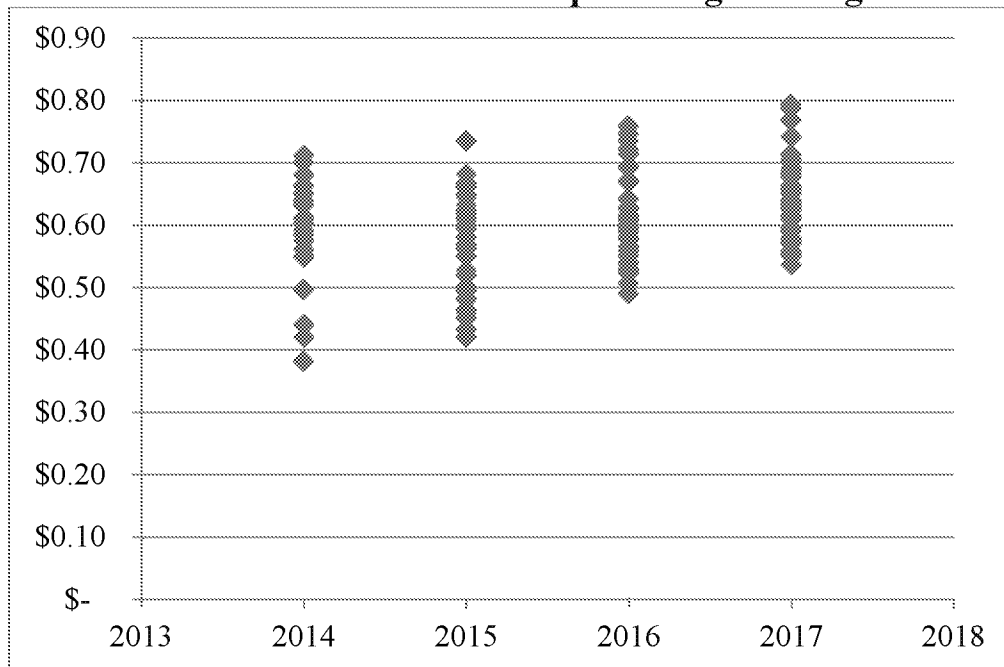


62. The evidence indicates that Rockfon's SACT prices similarly vary between regions of the United States. For example, Rockfon's best-selling SACT is its 2'x2' square tegular Artic tile.⁸⁶ Figure 6 below shows the range of average net prices for this product across the Armstrong's Price Metros in each year. It shows that Rockfon's price for this product varies significantly between regions, similar to how Armstrong's prices for the same products vary between regions.

⁸⁵ "ROXARM80 awi regional price index percentiles.csv".

⁸⁶ "ROXARM82 most popular rockfon SACTs.csv" This product is identified in Rockfon sales data as PMRS product number 660.

Figure 6: Variation in Net Price Per Square Foot Between Pricing Metros for Rockfon 2'x2' Artic With Square Tegular Edge⁸⁷



63. The evidence also indicates that USG's SACT prices vary between major metropolitan regions of the United States.⁸⁸ Because USG has not produced sales data broken down by product, I cannot directly calculate how the prices for the same USG products vary between regions of the United States.

64. (ii) *Differences in Regional Prices Are Driven By Differences in Demand and Competition.* Industry participants have testified that these

⁸⁷ "ROXARM82 variation in pmrs660 prices.csv".

⁸⁸ I do not have any evidence one way or the other on the variation in CertainTeed prices between regions. CertainTeed has not produced sales data broken down by product and I have not seen any documentary evidence regarding how CertainTeed's prices vary between regions.

⁸⁹ USG-0000326 at USG-0000364 (USG agreement with L&W in connection with the sale of L&W to ABC Supply).

differences in regional prices are driven in part by differences in demand and competition. For example, an Armstrong employee has testified that prices were higher in New York City than in Jacksonville, Florida in part because the “material cost [of ceilings is] less critical” to contractors in New York City, implying that demand for SACTs is more inelastic in New York City.⁹⁰ The evidence also indicates that regional differences in competition also drive the regional differences in prices. For example, Armstrong employees have testified that

[REDACTED]. Specifically, Armstrong’s sales manager in charge of the Western United States testified that [REDACTED]

[REDACTED] This confirms that impairing competition in a regional market will cause price increases specific to that region. Similarly, Armstrong’s Director of Pricing has testified that [REDACTED]

[REDACTED]⁹²

[REDACTED]⁹³

Similarly, a study performed by marketing consultants for Rockfon observed that

⁹⁰ Pasquerello (AWI) July 13, 2018 Deposition at 58 (“A: . . . Let’s take Ultima which was one of the huge products that Cemex diverted from Jacksonville to New York? Okay? Ultimate in Jacksonville might sell for \$[REDACTED] a foot and it might install for \$[REDACTED] a foot. In New York City it might sell for \$[REDACTED] and install for \$[REDACTED] a foot or \$[REDACTED] a foot. . . .when labor rates become more expensive and become more of a factor in the installed cost, material cost becomes less critical.”)

⁹¹ Lay (AWI) August 14, 2018 Deposition at 90 (“[REDACTED]

[REDACTED]).

⁹² McKinney (AWI Director of Pricing for Ceiling Tiles) Deposition at 44 ([REDACTED]

[REDACTED]).

⁹³ McKinney (AWI Director of Pricing for Ceiling Tiles) Deposition at 61-63 (“[REDACTED]

[REDACTED]).

prices varied by up to 30% between different regions of the United States, and that this variation was driven in part by differences in “competitive intensity.”⁹⁴

65. (iii) *Regression Analysis Measuring Differences in Armstrong Prices Between Pricing Metros.* Evidence that the prices Armstrong charges in a given Pricing Metro are more than 5% different than its prices in the closest Pricing Metro for the same products directly shows that Armstrong, even without having a 100% monopoly, is able to elevate prices 5% above competitive levels in the Pricing Metro without so many customer substituting to other areas so as to make the price difference unprofitable. This is because if there were significant customer substitution between the two Pricing Metros, Armstrong could not profitably maintain an elevated price for the same products in the higher-priced region because customers in that region would simply substitute to the lower-priced region. Note importantly that the converse is not true: the fact that Armstrong’s prices are less than 5% different between two regions does not necessarily indicate that there is significant substitution between the two regions because the similarity in prices could be due to underlying similarities in the factors that determine profit-maximizing prices (namely demand, cost, and competition intensity), rather than because customers substitute between the regions.

66. To measure price differences across Armstrong Pricing Metros, I ran the following regression for each Armstrong Pricing Metro:

$$\ln(\text{price}) = b_0 + b_1 * \text{inTestArea} + b_2 * \text{ContractorDistributor} + a_y + a_p$$

67. I run this regression 61 times: once for each Pricing Metro within the United States. In each regression, the data includes only Armstrong sales within either the “Test” Pricing Metro or the closest Pricing Metro to that “Test” Pricing Metro. For example, the closest Pricing Metro to the New York Pricing Metro is the New Jersey Pricing Metro, so the regression testing whether prices in New York differ from prices in the nearest area includes observations only from the New York and New Jersey Pricing Metros.⁹⁵ In each regression, each transaction

⁹⁴ ROXUL_1875139 at ROXUL_1875156; Medio (Rockfon 30(b)6) Deposition at 98 (“Q: So that goes back to the notion that people in the same metropolitan area get the same price? A: Yeah, generally people with a similar relationship in a similar area get a similar price.”).

⁹⁵ I determined which Pricing Metro was closest by having a computer program measure the distance between the centers of each of the Pricing Metros, with the center of a Pricing Metro

in Armstrong's data is a separate observation (each transaction constitutes the sale of a single product to a single customer on a single day). The dependent variable, $\ln(\text{price})$, is the natural logarithm of the price per square foot of that transaction (using the natural logarithm allows the regression to measure percentage changes in price rather than differences in the absolute value of the price). The independent variable of interest inTestArea_r , is an indicator variable equal to 1 (on) if the transaction was made to a customer located in the "Test" pricing metro (New York in this example) and 0 (off) otherwise. The coefficient b_1 therefore measures the effect of a customer being in the Test "Pricing Metro" on that customer's price, relative to if that customer were instead in the next-closest Pricing Metro. This regression includes a control variable, $\text{ContractorDistributor}$, which is an indicator variable equal to 1 if the customer is a Contractor or Distributor and 0 otherwise. I included this control variable because Armstrong's sales data shows that it generally charges significantly lower prices for the same products to Contractors and Distributors, as opposed to other types of customers such as retailers.⁹⁶ This regression also includes a set of dummy variables for each year (represented as a_y), which control for differences in Armstrong prices over time. Lastly, this regression also includes product fixed effects (a set of dummy variables and coefficients for each product), represented as a_p , which control for differences in the mix of products between the regions being compared.

68. Table 1 below shows the price differences estimated by these regressions. The estimated difference in price between regions was always statistically significantly different from 0. The absolute value of the estimated price difference is greater than 5% in 31 out of 61 test regions.

calculated as the average location of the customers that Armstrong assigned to each Pricing Metro.

⁹⁶ "ROXARM84 Price Variation between AWI Cust Groups.txt" (controlling for year, product, and geographic region, regression analysis shows that Armstrong charges similar prices to contractors and distributors, which are on average about 8-14% lower than prices to retailers or corporate strategic accounts).

Table 1: Regression Results Comparing Armstrong SACT Prices Between Closest Pricing Metros⁹⁷		
Test Area	Closest Area	Price Difference⁹⁸
ALASKA	SEATTLE	
AMARILLO	WEST TEXAS	
ATLANTA	EAST TENNESSEE	
AUSTIN	SAN ANTONIO	
BALT-WASH	PHILADELPHIA	
BIRMINGHAM-JACKSON	PENSACOLA	
BOSTON	HARTFORD	
CENTRAL TEXAS	DALLAS	
CHICAGO	ILLINOIS	
DALLAS	CENTRAL TEXAS	
DELAWARE	PHILADELPHIA	
DENVER	UTAH	
DES MOINES	ILLINOIS	
E TEXAS-N LOUISIANA	NEW ORLEANS	
EAST MICHIGAN	WEST MICHIGAN	
EAST TENNESSEE	KENTUCKY	
HARTFORD	NEW YORK	
HOUSTON	AUSTIN	
ILLINOIS	CHICAGO	
INDIANAPOLIS	WEST MICHIGAN	
KENTUCKY	WESTERN KENTUCKY	
LAS VEGAS	RENO	
LOS ANGELES	SAN FRANCISCO	
MEMPHIS	NW ARKANSAS	
MIAMI	TAMPA	
MIDWEST	WICHITA	
MINNEAPOLIS	DES MOINES	
MOUNTAIN	UTAH	
N TEXAS	DALLAS	
NASHVILLE	KENTUCKY	
NEBRASKA	MIDWEST	
NEW JERSEY	NEW YORK	

⁹⁷ “ROXARM84 comps to closestArea regressions.csv”.

⁹⁸ Because the dependent variable is the log of the price, the estimated price difference equals $e^{(b_1)} - 1$, where b_1 is the estimated coefficient of the inTestArea variable.

NEW ORLEANS	E TEXAS-N LOUISIANA	
NEW YORK	NEW JERSEY	
NORTH CAROLINA	SOUTH CAROLINA	
NORTH CENTRAL FLORIDA	TAMPA	
NW ARKANSAS	OKLAHOMA CITY	
OHIO	EAST MICHIGAN	
OKLAHOMA CITY	NW ARKANSAS	
PENSACOLA	BIRMINGHAM-JACKSON	
PHILADELPHIA	NEW JERSEY	
PHOENIX	LAS VEGAS	
PORTLAND	SEATTLE	
RENO	SAN FRANCISCO	
RICHMOND	BALT-WASH	
RIO GRANDE	WEST TEXAS	
SAN ANTONIO	AUSTIN	
SAN FRANCISCO	RENO	
SEATTLE	PORTLAND	
SOUTH CAROLINA	NORTH CAROLINA	
SPOKANE	SEATTLE	
ST LOUIS	ILLINOIS	
TAMPA	NORTH CENTRAL FLORIDA	
UPSTATE NEW YORK	NEW JERSEY	
UTAH	MOUNTAIN	
WEST MICHIGAN	CHICAGO	
WEST PENNSYLVANIA	BALT-WASH	
WEST TEXAS	AMARILLO	
WESTERN KENTUCKY	KENTUCKY	
WICHITA	OKLAHOMA CITY	
WISCONSIN	CHICAGO	

69. A finding that Armstrong's SACT prices differ by more than 5% between two regions means that both of the following must be true: (1) Armstrong's profit-maximizing prices in the two regions must be at least 5% different; and (2) there is not sufficient substitution between the two regions for customers to make a 5% price difference between the two regions unprofitable. Consequently, for the ■ regions with prices that are more than 5% different than its closest region, this analysis shows that both Armstrong's profit-maximizing

prices differ significantly between the regions and that there is insufficient substitution between the regions to prevent Armstrong from maintaining a 5% difference in prices between the regions. For the ■ regions with prices that are *not* more than 5% different from the nearest region, this analysis shows that at least one of the following is true, (1) Armstrong's profit-maximizing prices in the two regions are less than 5% different, due to underlying demand and competition being similar between the two regions, or (2) there is so much substitution between the two regions that Armstrong cannot profitably maintain a 5% price difference between the two regions. Given the evidence I describe below that customers cannot substitute between regions due to both contractual territorial restrictions and logistical issues (namely travel time), the regression results showing smaller than 5% price differences between regions most likely indicate that those particular regions happen to have similar profit-maximizing prices due to (currently) having similar levels of competition and demand. Although these regions' prices are currently similar to each other, it is still appropriate to define them as separate relevant geographic markets because Armstrong sets distinct prices for these regions and customers are unable to substitute between these regions (due to territorial restrictions and logistical issues), so Armstrong (or a hypothetical 100% monopolist) could profitably increase prices significantly in one of those regions (if, for example, demand in that region increased or competition decreased).

70. *(iv) Reliance on Local Distributors Prevents Customers from Substituting from One Regional Price Discrimination Market to Another.* Customers in higher-priced regions cannot substitute to lower-priced regions because 77% of SACT sales are made through distributors,⁹⁹ who sell only to nearby contractors. Contractors can turn only to nearby SACT distributors for two reasons: (i) SACT manufacturers prohibit distributors from selling SACTs outside of defined territories; and (ii) transportation costs make it more expensive for distributors to serve contractors that are far away. As I explain more below in Part I.C.1, manufacturers usually do not sell SACTs directly to contractors or building owners because distributors provide key services that the majority of contractors and building owners cannot efficiently self-supply. Only 9% of SACT manufacturer sales are made to direct purchasing contractors, and in any event such contractors also typically only operate within a local region.¹⁰⁰

⁹⁹ "ROXARM17 SACT Sales 2014-2017 by cust_group (ARM, USG, Rockfon).csv".

¹⁰⁰ "ROXARM17 SACT Sales 2014-2017 by cust_group (ARM, USG, Rockfon).csv"; McKinney Depo. at 64-65.

71. 1. Contractual Territorial Restrictions Prohibit Contractors from Substituting to Distributors in Lower-Priced Regions. Every Armstrong distributor agreement includes the following language, which prohibits distributors from selling Armstrong SACTs outside of their defined territory:

“Distributor is authorized to sell and distribute Ceiling Products (including will call or pick-up sales) only to accounts whose billing address is located in the Territory or for a construction project located in the Territory. In the event Distributor sells or distributes Ceiling Products in violation of this section, . . . Armstrong may (1) bill back to Distributor any discount given by Armstrong on the Ceiling Products involved; (2) suspend all discounts or rebate programs to Distributor for a term at the discretion of Armstrong; or (3) terminate Distributor [for cause]”¹⁰¹

72. Each Armstrong distributor agreement then defines the distributor’s territory, typically by listing the counties in which the distributor is allowed to sell Armstrong SACTs.¹⁰² The territories in which distributors are allowed to sell Armstrong products are [REDACTED]

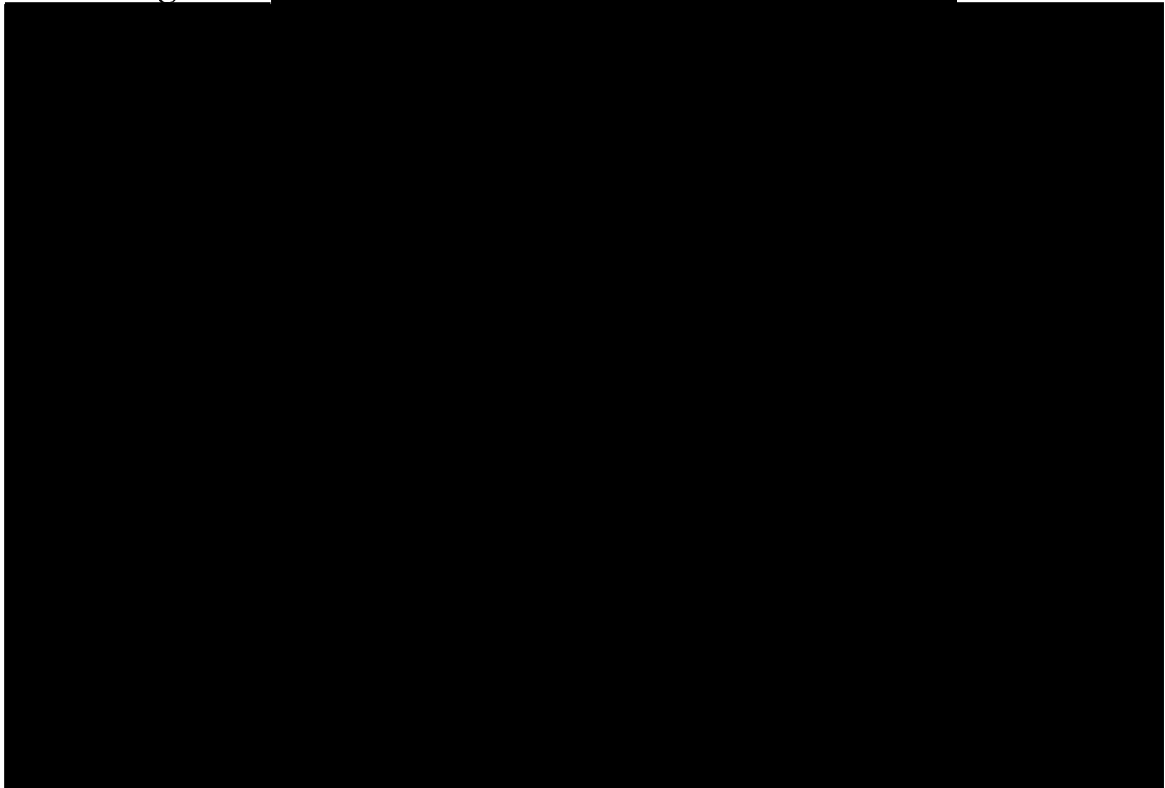
¹⁰¹ See, e.g., AWI00069591. Every Armstrong distributor agreement I have analyzed includes a territorial restriction. See “ROXARM75 AWI territory restriction prevalence.txt”.

¹⁰² See, e.g., AWI00069591 at AWI00069596 (agreement between AWI and Interior Supply of Columbus, listing the counties in Ohio in which Interior Supply is allowed to sell Armstrong SACTs).

Figure 7: [REDACTED] ¹⁰³



Figure 8: [REDACTED] ¹⁰⁴



¹⁰³ AWI00069774 at AWI00069779.

¹⁰⁴ “USA Northeast.jpg”

73. Similarly, [REDACTED]

Figure 9: [REDACTED]

74. [REDACTED]

[REDACTED] ¹⁰⁶ and a USG distributor has testified that USG imposed territorial restrictions. ¹⁰⁷ Further, [REDACTED]

¹⁰⁸

¹⁰⁵ AWI00069783 at AWI00069792.

¹⁰⁶ See, e.g., FBM 000209 (“FBM agrees not to sell or promote USG ceilings in the following California counties: San Diego, Imperial...”); USG-0000322 [REDACTED]

USG-0000324

¹⁰⁷ McCatty Deposition at 22-23 (“Q: Do you have any territorial restrictions with USG? A: We do. Q: And do you know what that is? A: It’s primarily the west side of the state [of Michigan], west to central side of the state”).

¹⁰⁸ Compare USG-0000322 at USG-0000323 (USG territory map); with “USA Mid-Atlantic.jpg” (map showing Armstrong’s Richmond Price Metro).

75. Similarly, every CertainTeed distribution agreement I have seen
[REDACTED]¹⁰⁹
CertainTeed's [REDACTED]
[REDACTED]¹¹⁰

76. Customers thus cannot evade high prices in higher-priced regions by buying from distributors in lower-priced regions because distributors in lower-priced regions are prohibited from selling Armstrong, USG, or CertainTeed SACTs in the higher priced regions. Those three brands constitute 98-100% of all SACT sales in the United States (depending on the year).¹¹¹ Nor can customers in high-priced regions switch to buying Rockfon SACTs from those distributors in lower-priced regions because: (1) Armstrong's distributor contracts consistently prohibit them from purchasing Rockfon at Armstrong locations (see *infra* Parts II.C-E); (2) Armstrong's contracts with FBM and GMS prohibit even those companies' non-Armstrong locations from purchasing Rockfon SACTs (see *infra* Part II.B); (3) it is not practical or efficient to purchase SACTs from a distributor that is far away (see next section below). Further, because these four firms (Armstrong, USG, CertainTeed, and Rockfon) collectively account for 99.9% of SACT sales in North America,¹¹² customers in higher priced-regions cannot avoid those higher prices by trying to purchase other brands of SACTs from distributors in lower-priced regions.

77. These contractual restrictions prohibiting distributors from selling outside of their allotted territory are independently sufficient to show that if a hypothetical monopolist in one area charged higher prices, customers could not switch to distributors in another region. For example, these territorial restrictions

¹⁰⁹ See, e.g., CERTAINTEED000036 [REDACTED]
[REDACTED]

¹¹⁰ See, e.g., CERTAINTEED000021 at CERTAINTEED000024 [REDACTED]
[REDACTED] CERTAINTEED000015 at
CERTAINTEED000018 [REDACTED]
CERTAINTEED000027 at CERTAINTEED000031 [REDACTED]
[REDACTED] CERTAINTEED000036 at [REDACTED]
[REDACTED]

¹¹¹ See *infra* Part B.2.

¹¹² See SKP001372 at SKP001373 (December 2014 estimate by the consulting firm Simon Kucher Partners estimating that revenue market shares in "North America" defined as "US & Canada" were 50.91% for Armstrong, 33.50% for USG, 14.5% for CertainTeed, and 1% for Rockfon. This would imply that all other firms combined had a 0.09% of share of the market).

prohibit a contractor or distributor in New York from evading Armstrong's higher New York list prices by purchasing from Armstrong, USG, or CertainTeed distributors in lower-priced regions such as Jacksonville, Florida. Indeed, in 2015 Armstrong terminated CEMEX, a distributor in Florida, at least in part because Armstrong believed that CEMEX was knowingly violating these territorial restrictions by selling SACTs to distributors in New York City.¹¹³ Moreover, Armstrong later went on to sue CEMEX for the revenue Armstrong lost from selling these SACTs to CEMEX at the lower Jacksonville prices rather than the higher New York City prices.¹¹⁴

78. Here, these territorial restrictions mean that impairing competition in a particular regional market, for example by foreclosing rivals from access to distribution in that region, would allow Armstrong to raise prices in that region even if prices were not supracompetitively elevated in other regions.

79. 2. Transportation Costs Make It Inefficient for Contractors to Purchase SACTs from Distant Distributors. Contractors also cannot turn to distant distributors because transportation costs make it inefficient for distributors to sell to distant contractors. Distributors typically transport SACTs from their warehouse to the job site via trucks and then have their staff disperse the SACTs throughout the job site. Consequently, the further away the job site is from the distributor, the higher the distributor's fuel and labor costs will be. This is consistent with the testimony of Armstrong's Director of Pricing, who stated that Armstrong sets different list prices throughout the U.S. in part because "construction is still a local and regional activity" and contractors "don't travel hundreds of miles to do work."¹¹⁵ Armstrong's recently-retired Senior Vice President for the Americas echoed this point, testifying that "there's an economic distance that [distributors] can operate in profitably. If they go outside of that range, it becomes unprofitable because of the freight costs."¹¹⁶ Similarly, a distributor in southeast Michigan explained that it didn't try to sell Rockfon tile

¹¹³ AWI Second Amended Counter Claims in Cemex v. Armstrong, Case No 3:16-cv-00186.

¹¹⁴ AWI Second Amended Counter Claims in Cemex v. Armstrong, Case No 3:16-cv-00186.

¹¹⁵ McKinney (AWI Director of Pricing for Ceiling Tiles) at 64-65 ("Q: Why does Armstrong set different list prices for 62 different regions in the U.S.? A: . . . construction is still a local and regional activity. Contractors are to determine --. They don't -- you know, the vast majority of them don't travel hundreds of miles to do work. So they're centered around certain areas.").

¹¹⁶ Cookson Deposition at 125-126.

outside southeast Michigan because “from a logistical standpoint it didn’t make sense to drive too far,”¹¹⁷ and a distributor with locations throughout Wisconsin testified that it only served parts of Wisconsin and Northern Illinois due to the “logistics” necessary to “truck and serve” customers.¹¹⁸ Rockfon’s President has likewise testified that, even though Rockfon does not limit the geography in which its distributors can sell Rockfon SACTs, distributors concentrate on selling in the regions in which they have physical branch offices for practical reasons.¹¹⁹

80. *(v) Regional Markets in Canada Are Distinct from U.S. Regional Markets.* Armstrong has distinct Pricing Metros specifically for Canada that do not overlap with any Pricing Metros in the United States.¹²⁰ Rockfon and Armstrong employees have both testified that customers in the U.S. essentially never purchase SACTs from distributors in Canada (and vice versa) due to customs, import duties, and currency differences.¹²¹ The Canadian regional markets are thus not relevant to assessing regional market effects within the United States. Because the Court has held that its jurisdiction is limited to effects within the United States, I accordingly exclude the Canadian regional markets from my regional market analysis.

¹¹⁷ McCatty Deposition at 61.

¹¹⁸ Downing (Badgerland Supply) Deposition at 47 (“Q: . . . what parts of Wisconsin does Badgerland distribute CertainTeed tile? A: I would say all of Wisconsin with exception to the northwest corner of the state. Q: Do you know why not the northwest? A: Logistics. Q: Okay, and anywhere outside of Wisconsin? A: Northern Illinois. Q: Okay. Is Badgerland limited to this geographic area by CertainTeed? A: No. Q: Okay. Do you know why Badgerland does not sell tile outside of Wisconsin and northern Illinois? A: Again, logistics. Q: And why you say ‘logistics,’ I assume trucking – A: Our ability to serve – yeah, to truck and service”).

¹¹⁹ Medio (Rockfon 30(b)(6)) Deposition at 103 (“Q: Do Rockfon customers, resellers, have geographic limitations as to where they can sell Rockfon products? A: No. . . . Q: Do a lot of your customers tend to sell in the – tend to concentrate their selling in the regions where they have physical branch offices? A Yes.”); Medio (Rockfon 30(b)(6)) Deposition at 219 (“Q: And Rockfon has no concerns if a distributor on the east coast decides to sell product on the west coast? A: It just doesn’t happen. I mean, it for the most part impractical.”).

¹²⁰ “ROXARM65 awi unique price metros.txt”.

¹²¹ Medio (Rockfon 30(b)(6)) Deposition at 69 (“A: So in ceiling tile cases, a contractor or end user who’s looking to purchase ceiling tile would have a very difficult time from importing it from anywhere other than a local distributor because of supply chain costs, minimum order quantities, regulatory differences to the product that’s available on the shelf. . . . They’d have to deal with customs and import duties and everything else.”). McKinney (AWI Director of Pricing) Deposition at 70 (“Q: Do contractors in the United States every buy ceiling tiles from Mexico? A: I’m not aware of it. Q: What about Canada? A: I’m not aware of it”).

B. Competitors and Market Shares

81. Armstrong executives have acknowledged that Armstrong is “#1 in the Ceilings business in every market that [Armstrong] participate[s] in.”¹²² Various sources confirm that only four competitors have obtained at least a 1% share of SACT sales in the United States: (1) Armstrong, (2) USG, (3) CertainTeed, and (4) Rockfon.¹²³ Consequently, the SACT industry is highly concentrated, with a Herfindahl-Hirschman Index (“HHI”) of well over 2500 for all of North America combined, all of the United States combined, and all of the regional markets within the United States.¹²⁴ Third-party estimates indicate that the four firms I have received data from (Armstrong, USG, CertainTeed, and Rockfon) combined constitute 99.9% of SACT sales in North America.¹²⁵ The sum

¹²² May 21, 2014 Armstrong Analyst/Investor Day Transcript.

¹²³ Pasquerello (AWI) Deposition at 22 (“Q: Who are the competitors in the ceiling tile space in the United States? A: USG, you’ve got CertainTeed. Obviously Rockfon. There are some other smaller players. OWA is a name that comes up from time-to-time. But they’re not really that large a factor. But those as far as the acoustical ceiling panels which again you’re referring to, those would be the primary competitors.”); May 16, 2016 Analysis of AWI by Jason Marcus of J.P. Morgan, Figure 7 (“North American Ceilings Market share (tile and grid)” Armstrong 55%, USG 30%, CertainTeed 10%, Rockfon 1%, “Others” 4%); McKinney (AWI Director of Pricing for Ceiling Tiles) Deposition at 18-19 (“Q: Who were the competitors in the suspended acoustical ceiling tile business in the United States? A: The – Armstrong, USG, CertainTeed, ROCKFON. And I’m not aware of anybody of any significance beyond that. Q: And you say any significance, you mean no one else that has probably even a one percent market share? A. Correct.”). Loufek (AWI) Deposition at 22 (“Q: In the suspended acoustical ceiling tile space, who are the competitors in the United States, manufacturers? A: There would be, to us, three that would come to mind. That would be United States Gypsum, CertainTeed . . . and Rockfon”); McCatty (GMS) Deposition at 15 (“Q: Who are the competitors, the product manufacturers, in the U.S. acoustical ceiling business in the United States? A: Armstrong, USG, Rockfon Chicago Metallic, and CertainTeed”).

¹²⁴ The HHI is calculated by “summing the squares of the individual firms’ market shares.” DOJ/FTC Horizontal Merger Guidelines §5.3 (2010). The Merger Enforcement Agencies classify markets into three types based on HHI: “Unconcentrated markets: HHI below 1500, Moderately Concentrated Markets: HHI between 1500 and 2500, Highly Concentrated Markets: HHI above 2500.” *Id.* Armstrong’s 50% or greater share within the U.S. or North America is alone sufficient to make the market’s HHI at least 2500. Every Price Metro in the United States also has an HHI above 2500 – the minimum HHI is 3262, the mean is 5238, and the maximum is 10000. “ROXARM65 Regional HHIs.txt”.

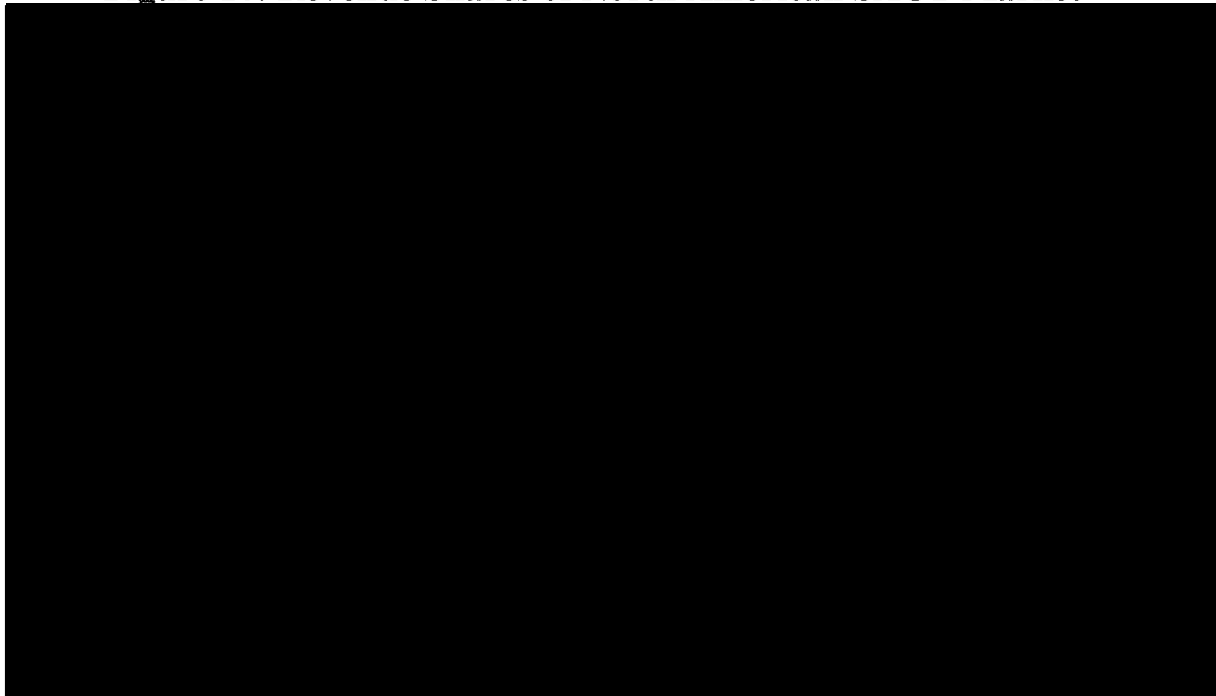
¹²⁵ See SKP001372 at SKP001373 (December 2014 estimate by the consulting firm Simon Kucher Partners estimating that revenue market shares for “tile” in “North America” defined as “US & Canada” were 50.91% for Armstrong, 33.50% for USG, 14.5% for CertainTeed, and 1% for Rockfon. This would imply that all other firms combined had a 0.09% of share of the market).

of these four firms' sales is thus an accurate estimate of the total sales in the SACT markets within North America.

1. North American Market Shares

82. Figure 10 below shows the revenue shares of the North American SACT market. Armstrong has consistently had a [REDACTED] share of North American SACT sales throughout 2013-2017, and USG has similarly consistently maintained a [REDACTED]% share. Combined, Armstrong and USG have accounted for [REDACTED]% of SACT revenue in North America throughout 2013-2017. Their high combined shares mean that their contracts prohibiting distributors from buying rival manufacturers' SACTs (described below in Part II) foreclose large shares of the North American SACT market.

Figure 10: Revenue Shares of North American SACT Market¹²⁶

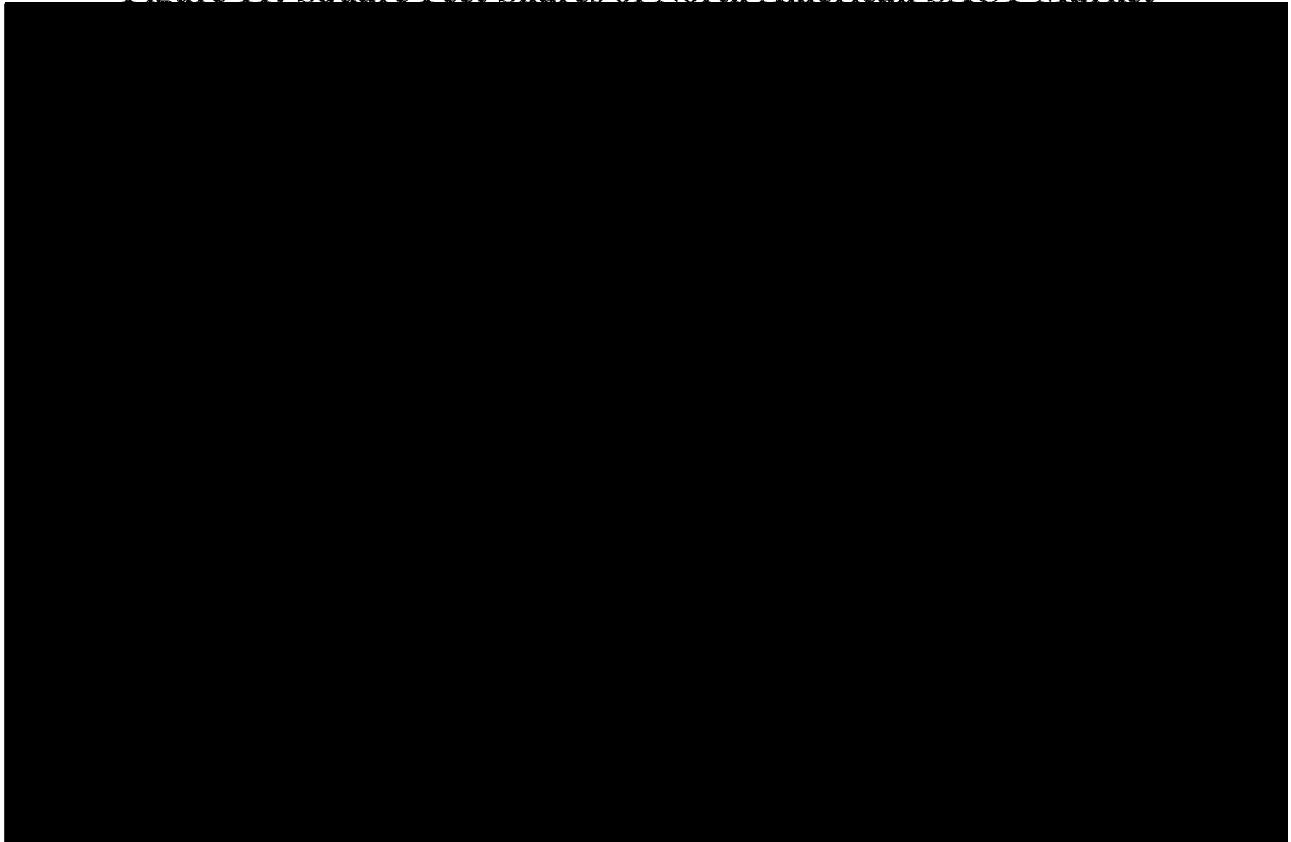


83. Figure 11 below shows square-foot shares of the North American SACT market. Armstrong's square-foot shares are slightly lower than its revenue shares because [REDACTED] [REDACTED] Nonetheless, Armstrong's North American square foot share was consistently above [REDACTED]% throughout 2013-2017 (ranging from [REDACTED]%). USG's

¹²⁶ "ROXARM25 North American SACT Shares.csv".

North American square-foot share was consistently █%, and Armstrong and USG's combined square foot share ranged from █%.

Figure 11: Square Feet Shares of North American SACT Market¹²⁷



2. U.S. Market Shares

84. Although exact market shares vary between geographic regions of the United States, overall shares of U.S. SACT sales confirm that Armstrong dominates most of these markets, with an overall average revenue share of █% and an overall average square foot share of █% from 2013 to 2017. This is consistent with an internal Armstrong document from 2017 estimating that Armstrong's share of the U.S. SACT market was █%.¹²⁸

¹²⁷ "ROXARM25 North American SACT Shares.csv".

¹²⁸ AWI00283664 at AWI00283672

Figure 12: Revenue Shares of the U.S. SACT Market¹²⁹

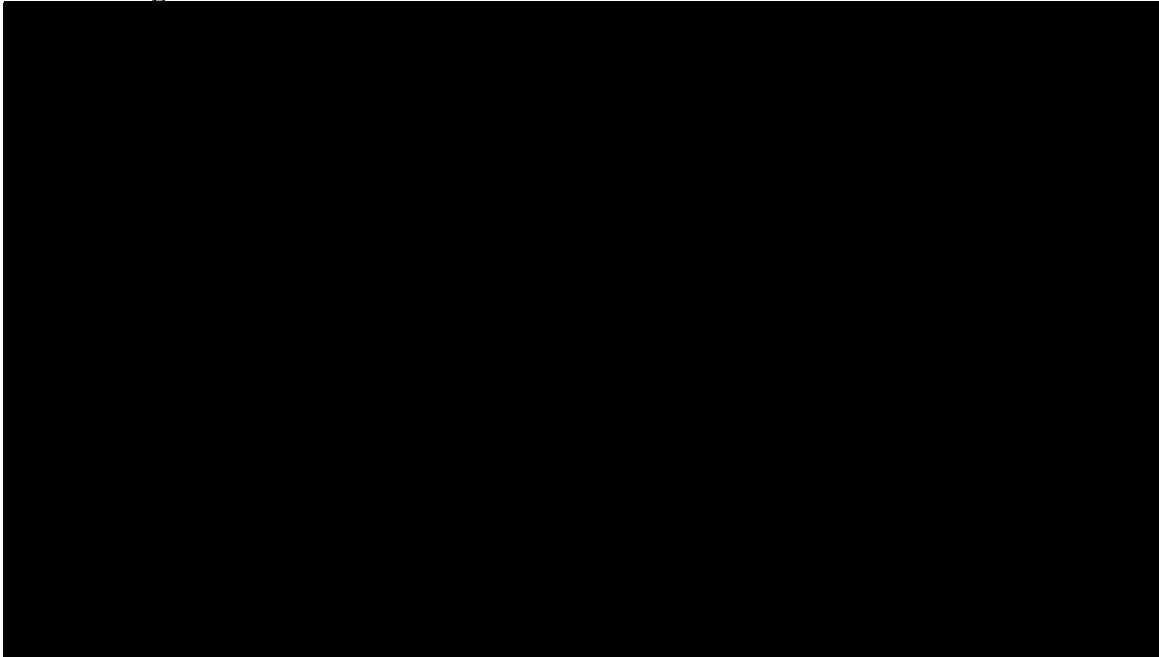
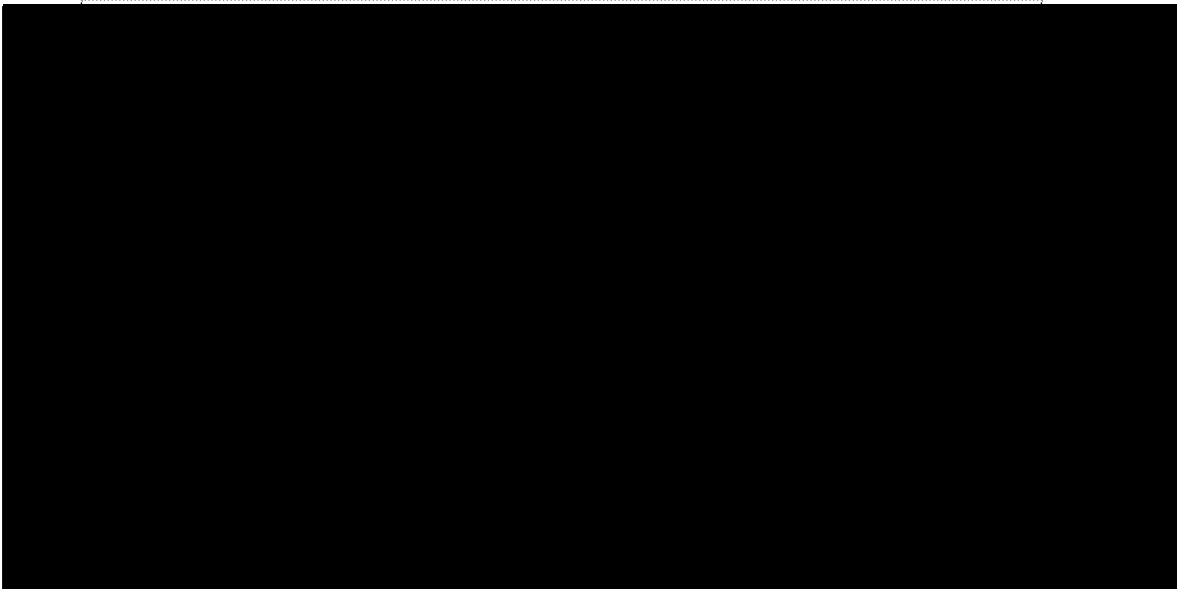


Figure 13: Square Feet Shares of the U.S. SACT Market¹³⁰



¹²⁹ “ROXARM25 US SACT Market Shares.csv”.

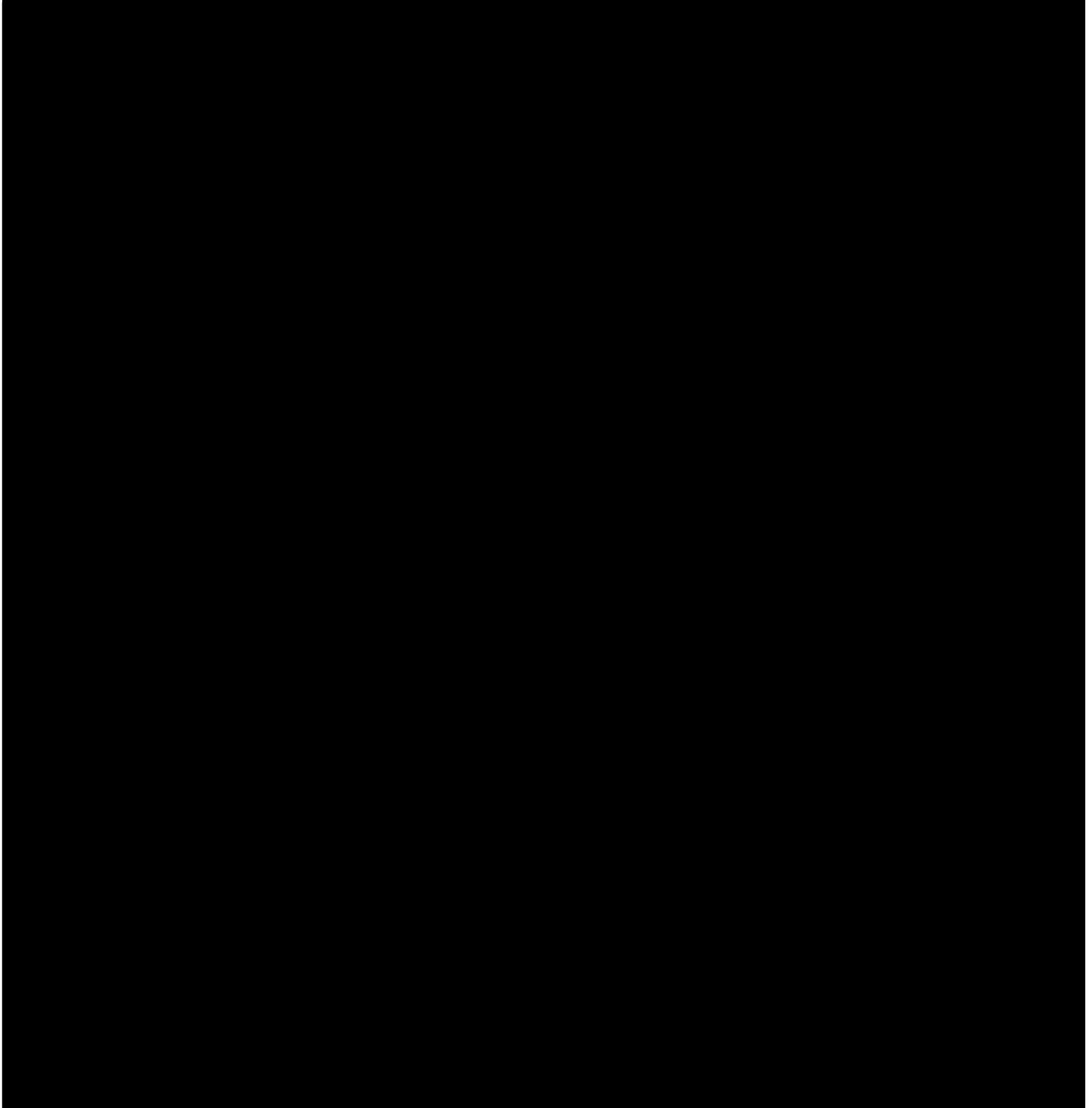
¹³⁰ “ROXARM25 US SACT Market Shares.csv”.

3. Regional Market Shares

85. Table 2 below shows the average revenue market shares of Armstrong, USG, CertainTeed, and Rockfon in each Price Metro within the United States, calculated over 2013-2017.¹³¹ [REDACTED]

¹³¹ USG's and CertainTeed's regional data are broken down by Metropolitan Statistical Area ("MSA"). The U.S. government has defined MSAs for the purpose of calculating regional statistics. MSAs are centered around major metropolitan areas and include neighboring areas that workers tend to commute between and have a similar population density. *See* www2.census.gov/geo/pdfs/reference/GARM/Ch13GARM.pdf. I determined the Price Metro that each MSA belonged to by calculating the distance between the center of each MSA and the customers that Armstrong included in its Price Metros.

**Table 2: Average Revenue Market Shares by Price Area
(2013-2017), Sorted Largest Price Area to Smallest¹³²**



¹³² “ROXARM65 Average Rev Share 2013-2017 by PriceArea.csv”.

WEST MICHIGAN	
ST LOUIS	
TAMPA	
RENO	
NEW ORLEANS	
DES MOINES	
PORTLAND	
AUSTIN	
MEMPHIS	
UTAH	
KENTUCKY	
SAN ANTONIO	
NEBRASKA	
RIO GRANDE	
NASHVILLE	
E TEXAS-N LOUISIANA	
EAST TENNESSEE	
MOUNTAIN	
LAS VEGAS	
SPOKANE	
ILLINOIS	
WICHITA	
NW ARKANSAS	
CENTRAL TEXAS	
ALASKA	
AMARILLO	
WESTERN KENTUCKY	
WEST TEXAS	
DELAWARE	
N TEXAS	

86. Table 3 below shows that Armstrong

Table 3: Distribution of Armstrong SACT Revenue Share in Price Metros (Number of Metros with a Given Armstrong Market Share)¹³³					
Armstrong Market Share	2013	2014	2015	2016	2017
0-9%					
10-19%					
20-29%					
30-39%					
40-49%					
50-59%					
60-69%					
70-79%					
80-89%					
90-100%					
Total ≥50%					

87. Table 4 below shows the distribution of USG market shares among the U.S. price metros. It shows that USG has had a market share of greater than or equal to ■% in 24-28 metros, depending on the year.

Table 4: Distribution of USG SACT Revenue Share in Price Metros (Number of Metros with a Given USG Market Share)¹³⁴					
USG Market Share	2013	2014	2015	2016	2017

¹³³ “ROXARM65 AWI regional share distribution.csv”

¹³⁴ “ROXARM65 USG regional share distribution.csv”

88. Table 5 below shows how Rockfon's revenue market share has changed over time in each Price Metro from 2013 to 2017.

Table 5: Rockfon Revenue Market Share by Price Metro and Year¹³⁵					
Price Metro	2013	2014	2015	2016	2017
NEW YORK	0.4%	1.5%	1.6%	2.1%	1.9%
LOS ANGELES	0.0%	0.6%	0.7%	0.7%	1.1%
CHICAGO	0.0%	0.8%	1.1%	1.3%	2.4%
PHILADELPHIA	0.0%	0.1%	0.1%	0.4%	1.4%
BALT-WASH	0.0%	0.5%	0.9%	1.3%	1.8%
BOSTON	0.0%	0.0%	0.0%	0.0%	0.7%
OHIO	0.0%	0.2%	0.1%	0.1%	0.8%
HOUSTON	0.0%	0.5%	0.9%	1.0%	3.0%
DALLAS	0.0%	0.5%	0.8%	3.2%	4.1%
SAN FRANCISCO	0.0%	1.4%	4.3%	6.0%	5.7%
NORTH CAROLINA	0.0%	0.0%	1.5%	2.2%	2.5%
ATLANTA	0.0%	0.1%	1.2%	1.1%	1.0%
MINNEAPOLIS	0.0%	0.3%	0.2%	0.1%	0.6%
HARTFORD	0.0%	0.0%	0.0%	0.0%	0.7%
WISCONSIN	0.0%	0.1%	0.5%	0.5%	1.1%
DENVER	0.0%	0.9%	1.3%	2.1%	2.2%
NORTH CENTRAL FLORIDA	0.0%	0.4%	0.9%	1.4%	1.0%
MIAMI	0.0%	0.5%	1.1%	1.7%	2.1%
NEW JERSEY	0.0%	0.0%	0.0%	0.0%	1.1%
UPSTATE NEW YORK	0.0%	0.3%	0.7%	0.9%	1.0%
PHOENIX	0.0%	0.0%	1.3%	0.6%	1.6%
WEST PENNSYLVANIA	0.0%	0.1%	0.7%	0.4%	1.6%
INDIANAPOLIS	0.0%	0.1%	0.0%	0.2%	0.1%
BIRMINGHAM-JACKSON	0.0%	0.0%	0.1%	0.1%	0.2%
SEATTLE	0.0%	0.0%	1.6%	2.0%	4.9%
EAST MICHIGAN	0.0%	1.4%	3.3%	4.0%	2.0%
MIDWEST	0.0%	0.0%	0.5%	2.0%	2.8%
SOUTH CAROLINA	0.0%	0.0%	0.0%	0.2%	1.1%
RICHMOND	0.0%	0.5%	0.2%	0.3%	3.0%
PENSACOLA	0.0%	0.0%	0.5%	0.5%	0.3%
OKLAHOMA CITY	0.0%	0.0%	0.4%	0.6%	0.5%
WEST MICHIGAN	0.0%	0.0%	0.6%	1.1%	1.1%
ST LOUIS	0.0%	0.0%	0.0%	0.0%	0.4%

¹³⁵ ROXARM65 Rockfon Regional Shares 2013-2017.csv.

TAMPA	0.0%	0.1%	3.0%	1.3%	2.8%
RENO	0.0%	0.0%	0.1%	0.1%	0.1%
NEW ORLEANS	0.0%	0.3%	0.8%	1.1%	1.4%
DES MOINES	0.0%	0.6%	1.8%	1.7%	1.5%
PORTLAND	0.0%	0.0%	0.4%	1.4%	2.5%
AUSTIN	0.0%	0.1%	1.5%	6.5%	3.6%
MEMPHIS	0.0%	1.3%	0.9%	2.5%	2.7%
UTAH	0.0%	2.3%	4.4%	8.8%	8.8%
KENTUCKY	0.0%	0.2%	0.7%	0.7%	1.0%
SAN ANTONIO	0.0%	0.0%	0.9%	1.6%	2.3%
NEBRASKA	0.0%	0.3%	2.9%	1.9%	2.4%
RIO GRANDE	0.0%	0.2%	1.8%	7.8%	8.5%
NASHVILLE	0.0%	0.1%	0.1%	0.8%	0.8%
E TEXAS-N LOUISIANA	0.0%	0.0%	1.6%	3.9%	4.1%
EAST TENNESSEE	0.0%	0.0%	0.4%	0.9%	0.6%
MOUNTAIN	0.0%	1.2%	2.9%	2.8%	2.6%
LAS VEGAS	0.0%	0.0%	0.2%	1.0%	2.1%
SPOKANE	0.0%	0.0%	0.0%	0.0%	0.0%
ILLINOIS	0.0%	0.0%	0.5%	1.4%	0.2%
WICHITA	0.0%	0.0%	0.0%	1.0%	1.9%
NW ARKANSAS	0.0%	0.0%	0.0%	1.3%	5.8%
CENTRAL TEXAS	0.0%	0.0%	0.6%	0.0%	0.0%
ALASKA	0.0%	0.0%	0.0%	0.0%	0.0%
AMARILLO	0.0%	0.0%	0.0%	0.0%	0.0%
WESTERN KENTUCKY	0.0%	0.0%	0.0%	1.1%	0.2%
WEST TEXAS	0.0%	0.0%	0.0%	0.0%	0.0%
DELAWARE	0.0%	1.0%	2.3%	9.4%	12.4%

C. Market Power and Monopoly Power

89. Armstrong has both market power and monopoly power (a higher degree of market power) in many regional markets throughout the United States. Three independently sufficient bases confirm Armstrong's market power and monopoly power: (1) high market shares (greater than 50%) coupled with high barriers to entry and expansion; (2) direct evidence that Armstrong has the power to raise prices above competitive levels; and (3) direct evidence that Armstrong has the power to exclude rivals.

90. The evidence also indicates that USG, the second-largest SACT manufacturer in North America, has market power (but not monopoly power) in North America in general and in many of the regional markets throughout the United States. USG's market power is relevant to my analysis because USG has entered into exclusive dealing agreements with its distributors that have contributed to the marketwide foreclosure of rival SACT manufacturers.

1. High Market Shares Coupled With High Barriers to Entry and Expansion

91. A high market share indicates that a firm has significant market power when the market also exhibits high barriers to the entry of new rivals and the expansion of existing rivals. Here, Armstrong has in every relevant year had a dominant revenue market share of over █% in North America and the United States, and has averaged a greater than 50% share in █ of the 61 regional markets within the United States. Armstrong's high market shares (coupled with entry and expansion barriers) indicate market power and monopoly power because they make Armstrong more likely to have power over price. Armstrong's high market shares also indicate that: (1) it controls enough of this market to restrain substantial shares; and (2) it will profit from a successful exclusionary scheme more than firms with smaller market shares would.¹³⁶

92. The evidence also indicates that USG has significant market power (but not monopoly power) in North America: its revenue market share has been █% in North America and the United States. USG also has a greater than █% share in 24-28 of the 61 regional markets within the United States (depending on the year). As the second-largest SACT manufacturer in North America, USG benefits from the same barriers to entry and expansion that protect Armstrong's high market shares.

93. Below, I present the evidence supporting my conclusion that there are substantial barriers to entry and expansion in the in the North American SACT market and the regional price discrimination markets. My conclusion that barriers to entry are high is consistent with the reports of multiple independent analysts who have stated that barriers to entry are high in the North American ceilings industry.¹³⁷

¹³⁶ Einer R. Elhauge, *Defining Better Monopolization Standards*, 56 STAN. L. REV. 253, 335 (2003).

¹³⁷ See, e.g., Barker Exhibit 3 (Barron's article dated May 21, 2016 titled "Why Armstrong World Ceilings Are Looking Up) ("the U.S. ceiling market is a virtual duopoly, and

94. **a. Requirement of Large, Efficient Manufacturing Plants Poses Barriers to Entry and Expansion.** Market practice shows that competitors generally require multiple large, efficient manufacturing plants in order to produce a substantial amount of SACTs and sell them at competitive prices. Armstrong has six manufacturing plants that produce SACTs for North America,¹³⁸ USG has three,¹³⁹ and CertainTeed and Rockfon each have two.¹⁴⁰ These manufacturing plants require substantial investments and take a significant amount of time to build. For example, it cost Rockfon \$[REDACTED] to build its 130,000 square-foot manufacturing plant in Mississippi, and took slightly over 1 year to complete.¹⁴¹ The substantial investment necessary to build even one of these manufacturing plants can deter new firms from entering, especially when (as here) the dominant firms foreclose much of the market and therefore limit the ability of new firms to recoup their investment by making sales. Similarly, the cost and time of building a new manufacturing plant limits the ability of existing smaller firms to expand, especially here where marketwide foreclosure reduces the return on existing firms' investments in new manufacturing plants. This barrier to entry applies equally to every regional price discrimination market within North America because customers throughout North America demand SACTs with particular certifications

barriers to entry are high. Armstrong controls 55% and top rival USG 35%. No. 3 CertainTeed has a much smaller share"); Barker Exhibit 4 (investment analysis on Armstrong World Industries by the firm SunTrust Robinson Humphrey, dated April 20, 2015) ("Oligopoly structure has barriers to entry; one new entrant on the horizon. Ceilings are primarily sold through distributors that are usually exclusive to a single supplier in their markets. These distributors sell other items, particularly wallboard, which over economic periods is prone to cyclical pricing behavior. The result is ceilings, and its pricing, is a great category for these dealers with switching costs high. In addition, there is somewhat of an 'annuity' aspect of replacement of damaged or old tiles at very high margins that require the same supplier to match the existing ceilings. For these reasons, the channel is tough for new entrants to penetrate.")

¹³⁸ Armstrong 10-K for Fiscal Year 2017 at 15 (stating that Armstrong has 6 "Mineral Fiber" manufacturing plants in the United States, in Florida, Georgia, Ohio, Oregon, Pennsylvania, and West Virginia).

¹³⁹ AWI00009706 at AWI00009712.

¹⁴⁰ AWI00009706 at AWI00009712 (CertainTeed has two SACT manufacturing plants for the U.S.). SACTs Rockfon sells in North America are produced in a manufacturing plant in Poland and another in Mississippi that began production in July 2017. Rockfon Press Release, *Rockfon North America Facility Begins Production* (July 19, 2017), <http://www.rockfon.com/news+list/news?new=3632>

¹⁴¹ Rockfon broke ground on the Mississippi manufacturing plant in March 2016. <https://www.mississippi.org/general/rockfon-breaks-ground-on-acoustic-ceiling-tile-plant-in-marshall-county-miss/>. Production started in July 2017. <http://www.rockfon.com/news+list/news?new=3632>.

that differ from SACTs used in other regions.¹⁴² A SACT manufacturer must therefore have a large, efficient manufacturing plant that has obtained the specific certifications that North American customers demand in order to effectively compete in any portion of North America.

95. Further, although it is *possible* to compete in North America without a manufacturing plant in North America (as evinced by Rockfon importing all of its North American SACTs from Poland until July 2017), it is significantly more efficient to have a manufacturing plant in North America for multiple reasons: (1) the cost of obtaining SACTs in North America is generally cheaper if one manufactures them in North America because doing so avoids the cost of shipping the SACTs across the Atlantic Ocean from Europe; (2) having a manufacturing plant in North America significantly reduces lead times and logistical complexity because it takes a long time for SACTs manufactured in Europe to be shipped across the Atlantic and clear customs; (3) customers in the United States in particular place a higher value on the same model of SACTs if they are “Made in the U.S.A.” as opposed to elsewhere.¹⁴³

96. **b. Economies of Scale Are a Significant Barrier to Entry and Expansion.** There are “economies of scale” in the manufacturing of SACTs, meaning that a firm’s average variable costs or forward-looking average total costs are lower when a firm is producing more units.¹⁴⁴ Economies of scale pose a barrier to entry and expansion because they mean that larger incumbent firms will have lower per-unit costs than smaller firms even if the smaller rivals have the same cost functions as the larger firms.¹⁴⁵ Here, Armstrong has publicly stated that it benefits from economies of scale, stating that its “unparalleled” scale gives it a

¹⁴² See *supra* notes 65-66.

¹⁴³ See *infra* Part IV.A.

¹⁴⁴ CARLTON & PERLOFF, MODERN INDUSTRIAL ORGANIZATION 36-42 (4th ed. 2005) (“If average cost falls as output increases, the firm is said to have economies of scale”).

¹⁴⁵ For example, suppose in a given market that all firms have the same cost function that reflects economies of scale, $C_i = 10 - 0.1q_i$, where C_i is firm i ’s incremental cost, and q_i is firm i ’s quantity sold, meaning that each firm’s incremental cost is 10/unit for the first unit and decreases by 0.1 for each additional unit sold. In this hypothetical, a large incumbent firm that sold 50 units would have a incremental cost of only 5/unit ($10 - 0.1 \times 50$), whereas a new firm that sold only 10 units would have a incremental cost of 9/unit ($10 - 0.1 \times 10$). The larger incumbent firm would thus have a smaller incremental cost than the rival, not because it is inherently more efficient (both firm shave the same cost function), but simply because economies of scale favor larger incumbent firms over smaller firms.

“cost advantage on the manufacturing side,”¹⁴⁶ and more specifically that Armstrong could increase its volume by 20% with only a 4% increase in overall production workforce due to the automated nature of its production process.¹⁴⁷ Rockfon also experiences economies of scale, which I describe more below in Part IV.

97. These economies of scale pose a barrier to entry and expansion throughout all of North America because an increase in a rival’s cost of producing SACTs designed for North America due to failing to achieve economies of scale will reduce that rival’s ability to compete throughout all of North America. I describe how Rockfon could have achieved additional economies of scale but-for Armstrong’s foreclosure below in Part IV.

98. **c. Patent Protection Forces Rivals to Invent Around Existing Technologies.** Patents can pose significant barriers to entry and expansion because they force new entrants to invent around incumbent firms’ patents to enter the market. Here, Armstrong has filed numerous patents and has stated publicly that “patent protection is important to our business” and that its “competitive position has been enhanced by patents on products.”¹⁴⁸ These patents limit the entry and expansion of rivals throughout the United States because the patents prohibit rivals from selling products that infringe any incumbent’s U.S. patents in any area of the United States.

99. **d. Conduct Restricting Access to Distributors Is a Significant Barrier to Entry and Expansion.** The largest barriers to entry and expansion in each of the regional markets are Armstrong and USG restraints that foreclose rivals

¹⁴⁶ May 21, 2014 Armstrong Analyst/Investor Day Transcript (“our global reach and scale is unparalleled in this marketplace. We believe it’s a real significant advantage. It gives us a cost advantage on the manufacturing side, and it gives us a coverage advantage in the marketplace.”).

¹⁴⁷ May 21, 2014 Armstrong Analyst/Investor Day Transcript (“we have the opportunity to support a 20% increase in volume with only a 4% increase in overall production workforce due to the automated nature of our product – or production process.”).

¹⁴⁸ May 21, 2014 Armstrong Analyst/Investor Day Transcript (“We went stale for quite a while, post-emergence from bankruptcy. As you can see, though, the new team is focused on innovation and new products. And I think the best evidence of that is patents filed. So you look at this, 34 patents first filed in 2013. You have to go back to 1990 before you get a number close to 30.”); Armstrong 10-K for Fiscal Year 2017 at 6 (“Patent protection is important to our business. Our competitive position has been enhanced by patents on products and processes developed or perfected within AWI or obtained through acquisitions and licenses. In addition, we benefit from our trade secrets for certain products and processes.”).

from access to distributors. For all but a minority of contractors that have essentially vertically-integrated in order to self-supply distribution services, specialized building product distributors are the standard and most efficient means of selling SACTs. Manufacturer sales data confirms that contractors have a strong preference for purchasing through distributors: 77% of SACT sales are made through distributors, 13% are made through retailers (such as Home Depot) and only 9% are made directly to contractors.¹⁴⁹

100. The vast majority of contractors buy SACTs through distributors rather than directly from manufacturers because distributors efficiently provide numerous services that manufacturers do not offer to contractors, such as:

- (1) faster delivery¹⁵⁰
- (2) moving delivered materials throughout the job site to their appropriate locations¹⁵¹
- (3) carrying a wide range of products in addition to SACTs, allowing contractors to arrange for only a single delivery of all the building products they need at a given time to the job site, which can be especially beneficial when the job site is in a crowded city;¹⁵²

¹⁴⁹ “ROXARM17 SACT Sales 2014-2017 by cust_group (ARM, USG, Rockfon).csv”. This statistic is calculated over 2014-2017 for Armstrong, USG, and Rockfon, who collectively constitute 90% of U.S. SACT sales. This figure excludes CertainTeed because CertainTeed did not produce sales data broken down by customer type.

¹⁵⁰ Lay (AWI) August 14, 2018 Deposition at 72 (“A: [Distributors] provide local inventory of some of the more common stuff. So if a contractor needs something in a hurry and can’t wait for the next truck to come in, . . . they know they can go to the local distributor and get that inventory from them . . . And so sometimes it’s the lead times on jobs [that makes contractors prefer to use a distributor instead of purchase directly from a manufacturer]”).

¹⁵¹ Harold Barker (Armstrong Area Sales Manager) May 8, 2018 Deposition at 37 (“A: I know that [contractors] will sometimes choose distribution [instead of direct purchase] for logistical reasons. Armstrong is a manufacturer. We’re not going to load a job site, and stock, and scatter material or boom it to different floors on a job site which distributors will do. . . . We’re not going to warehouse material for them which distributors will do.”); Lay (AWI) August 14, 2018 Deposition at 20 (testifying that distributors provide services such as “stock and scatter”, which means for example “on a high rise where [the contractor] would want somebody else to take it up the stairs instead of [the contractor’s] guys doing it” and depositing the materials on each floor). FBM 2017 10-K at 3 (“We typically deliver wallboard and other products directly to the floor where it will be installed, from the first floor to the penthouse of a major high rise.”).

¹⁵² Olson (AWI) Deposition at 142 (“A: . . . you don’t find in the U.S. any distributors that are just acoustical distributors. They carry other lines. They carry drywall. They cover insulation, steel studs, I mean products like that. Acoustical might be . . . anywhere from 15 to . . . 15 percent” of distributor sales).

(4) the ability to continually deliver smaller amounts of product over time as the contractor needs it, whereas manufacturers are typically only willing to ship entire truckloads at a time;¹⁵³

(5) providing a warehouse for materials the contractor is not immediately using;¹⁵⁴

(6) the convenience of purchasing all or most necessary building products from one distributor rather than many manufacturers;¹⁵⁵ and

(7) typically, better credit and payment terms than manufacturers offer, which is important for contractors who do not have significant amounts of capital and may not be paid in full until the job is complete.¹⁵⁶

101. Armstrong has repeatedly acknowledged that access to distributors is vital for a SACT manufacturer and that restricting access to distributors limits rival entry and expansion. For example, Armstrong executives stated publicly in 2014 that “maintaining strong relationships with [its] distributors” was one of the three

¹⁵³ Lay (AWI) August 14, 2018 Deposition at 72-73 (“Q: And then we talked about the ease of delivery with the warehouse distributors, right? A: Uh-huh, it is. Q: Like the contractor can call up and say I need 10 percent of my order on Tuesday? A: And break it up. Q: Fifty percent next Tuesday? A: And schedule it that way, uh-huh. You’ll have guys that have been direct contractors for decades, you know, switch to the distributor, get rid of their warehouse and driver and all that kind of stuff and let the distributor do that for them. Q: Just for the convenience factor? A: Uh-huh”).

¹⁵⁴ Pasquerello (AWI) July 13, 2018 Deposition at 86 (“A: . . . Some [contractors] are too small really they don’t want a warehouse. They want to keep their over head down so they have a small little warehouse maybe and they have an office.”)

¹⁵⁵ Lay (AWI) August 14, 2018 deposition (“A: Normally customers prefer to buy [ceiling tile and grid] together, because it comes normally from one distributor versus having to go to two separate distributors to get stuff”); FBM 2017 10-K at 3 (“We serve as a critical link between our supplier base and a diverse and highly fragmented set of more than 28,000 customers. . . We believe that our customers select and trust us because we have the expertise to efficiently and effectively handle and deliver a broad product offering, including wallboard, metal framing, suspended ceiling systems, commercial and industrial insulation and complementary and other products”); GMS 2018 10-K at 4 (“We provide a comprehensive product offering of over 20,000 stock-keeping-units, or SKUs, of wallboard, ceilings and complementary interior construction products for interior contractors. By carrying a full line of wallboard and ceilings along with steel framing and ancillary products, we are able to serve as a one-stop-shop for our customers.”).

¹⁵⁶ Lay (AWI) August 14, 2018 Deposition at 72 (“Q: Do you offer specialized payment terms? What terms do you offer a contractor when they buy direct? A: Not as good as the local distributors normally”); Loufek (AWI) Deposition at 79 (“A: . . . there is a role that distributors clearly play in the credit and terms functions that manufacturers probably do not want to get into”); FBM 2017 10-K at 15 (“The majority of our net sales volume is facilitated through the extension of credit to our customers”).

main ways it could “protect and defend” its North American market position.¹⁵⁷ Similarly, Armstrong executives stated in this same public interview that firms need “access to distribution” and that “the stable distribution channel that we enjoy, plus USG and CertainTeed enjoys, is somewhat of a barrier to entry” that prevents other ceiling tile manufacturers from “moving to the U.S. and poisoning this wonderful profit pool we have.”¹⁵⁸ Armstrong has likewise publicly acknowledged in its financial disclosures that “Failure to . . . maintain[] . . . distribution relationships . . . could have a material adverse effect on our financial condition.”¹⁵⁹ Internally, an Armstrong executive told other Armstrong employees that Armstrong should “leverage strong channel relationships to create barriers to entrance” in response to Rockfon’s imminent entry, which the executive described as “the most significant competitive threat in 30 years.”¹⁶⁰ In deposition, an Armstrong employee testified that distribution was important to selling SACTs in the United States.¹⁶¹

102. Independent analysts have likewise confirmed that restricted access to distributors was the primary barrier to entry and expansion in the North American SACT market. For example, a May 2017 market research report explicitly stated that the “biggest barrier to entry in the U.S. ceiling tile market is access to the building product distribution network.”¹⁶² This same report explained that trying

¹⁵⁷ May 21, 2014 Armstrong Analyst/Investor Day Transcript (“the fact is that the bulk of our revenue is here [in North America], so priority #1 is to protect and defend our core. And we do that by driving productivity, by maintaining strong relationships with our distributors, by maintaining coverage of the architects and designers.”)

¹⁵⁸ May 21, 2014 Armstrong Analyst/Investor Day Transcript (“A question we get all the time from investors is, what prevents this mythical Chinese ceiling tile distributor or a manufacturer from moving to the U.S. and poisoning this wonderful profit pool we have ? The answer is, hey, we’ve got great specifications in the architecture community, like we say. But what you need is access to distribution. I mean, it’s a big part of the equation . . . the stable distribution channel that we enjoy, plus USG and CertainTeed enjoys, is somewhat of a barrier to entry.”).

¹⁵⁹ Armstrong 10-K for Fiscal Year 2017 at 9.

¹⁶⁰ AWI00010319 at AWI00010332 (June 22, 2012 presentation by Armstrong executive Victor Grizzle. The cited slide describes Rockfon’s imminent entry, and states that Rockfon has “Better acoustic” at a “lower price point.” It also states “leverage strong channel relationships to create barriers to entrance.” And “This is the most significant competitive threat in 30 years.”).

¹⁶¹ Loufek (AWI) Deposition at 79.

¹⁶² AWI00009000 at AWI0009002 (“Pushback from major distributors had been that Rockfon would have a tough time because of relationships with major ceiling tile producers AWI and USG. The biggest barrier to entry in the U.S. ceiling tile market is access to the building product distribution network. Given the high-consolidated nature of the ceiling tile industry,

to bypass the restricted access to distributors by selling directly to contractors would not be a “sustainable strategy” because “ceiling tile primarily is sold through the distribution network for a reason. If general contractors had to negotiate pricing for each individual building product used in a construction project, this would further exacerbate the already challenging bottlenecks in the construction process.”¹⁶³ Another investment analysis of the North American ceilings industry called “Distribution a Barrier” and explained that “Armstrong sells its products through third party distributors who provide both an inventory, and more importantly, a sales value in the value chain” and that “Armstrong requires their distributors to carry only their product, preventing competition to their goods.”¹⁶⁴

103. So-called “big-box” retailers, such as Home Depot and Lowe’s, are not reasonable substitutes for specialized building products distributors because big-box retailers do not provide the whole range of services that specialized building products distributors do. For example, an Armstrong employee explained that big-box retailers typically lack the “full breadth of product[s]” that specialized

distributors typically carry one of the major brands exclusively. According to TRG industry contacts, very few distributors carry dual products.”)

¹⁶³ AWI00009000 at AWI0009003 (“What is the impact of Rockfon selling direct to contractors? Rockfon in 2017 has been focusing on going directly to contractors to sell products. Will this be a sustainable strategy? We think not, as ceiling tile primarily is sold through the distribution network for a reason. If general contractors had to negotiate pricing for each individual building product used in a construction project, this would further exacerbate the already challenging bottlenecks in the construction process. No one has asked the ‘why?’ behind this direct-to-contractor strategy Rockfon is attempting. In our opinion, because Rockfon has faced greater than anticipated challenges to gaining a foothold with key distribution relationships and likely isn’t receiving the support they would like, the company is choosing to go direct to contractors. . . . History has shown that significant ceiling industry market share shifts take a long time to achieve, and given the steep distributor barriers to entry, we think it will be very challenging for Rockfon to gain market share in the near term.”) (underlines in original).

¹⁶⁴ Barker Deposition Exhibit 4 (investment analysis of AWI by the firm SunTrust Robinson Humphrey, dated April 20, 2015) at 12 (“Distribution a Barrier but Rockwool Makes Push into U.S. Ceilings. Armstrong sells its products through third party distributors who provide both an inventory and, more importantly, a sales value in the value chain. These distributors are in touch with the decision makers on commercial projects to get their products specified for the job. Generally, these distributors’ largest business is the sale of commercial wallboard and other commercial products such as steel studs in the mix. . . . Armstrong requires their distributors to carry only their product, preventing competition to their goods.”).

distributors provide, and that big-box retailers are not able to deliver products in logistically difficult locations such as downtown Chicago.¹⁶⁵

104. Because each distributor only serves nearby customers, foreclosing a distributor in a particular region of the United States creates a barrier to entry to that particular region of the United States rather than the entire country. Nonetheless, here Armstrong and USG have significantly foreclosed rivals from access to distributors in essentially every region in the United States, as I show below in Part III.A.4.

105. **f. Incontestable Demand for Partial Replacement of Previously-Installed Ceiling Tiles Protects Incumbent Market Shares.** Armstrong's dominant share of the SACT market is protected in part by the fact that there is significant incontestable demand for replacing damaged or worn-out Armstrong tiles in existing buildings. When building owners replace damaged or worn-out SACTs, they typically use the same brand and model of SACTs previously installed so that the replacement tiles match the existing tiles, which are usually Armstrong tiles due to Armstrong selling the majority of SACTs in the United States.¹⁶⁶ Because existing buildings far outnumber new construction, the slight

¹⁶⁵ Loufek (AWI) Deposition at 75-76 ("Q: Can big box stores, like a Home Depot or a Lowe's, provide those services to contractors? A: In terms of that full breadth of product, I would say probably not . . . in terms of the pure product knowledge and other things that goes around what are – the commercial distributors are into, they could fulfill part of it, but not everything that I would say a commercial distributor can do. Q: What about even like logistical delivery services? Maybe you want flooring one day and tiles another day. Are you aware of any of the big box stores being able to do that? A: Some will – some offer it. Whether we've really seen much of that taking place on big commercial projects, very doubtful. If you're putting a highrise in downtown Chicago, Home Depot's not delivering it.").

¹⁶⁶ Barker Deposition Exhibit 3 (May 2016 Barron's article titled "Why Armstrong World's Ceilings Are Looking Up") ("60% of revenue comes from replacing damaged or old tiles, a business in which the original supplier needs to match the existing tiles."); Barker Exhibit 4 (investment analysis on Armstrong World Industries by the firm SunTrust Robinson Humphrey, dated April 20, 2015) ("there is somewhat of an 'annuity' aspect of replacement of damaged or old tiles at very high margins that require the same supplier to match the existing ceilings. For these reasons, the channel is tough for new entrants to penetrate."); Barker Deposition Exhibit 4 (investment analysis of AWI by the firm SunTrust Robinson Humphrey, dated April 20, 2015) at 12 ("tiles need to be routinely replaced due to water, damage, discoloration for various reasons, or damage during HVAC or electronics work. We believe this purchase is usually for the same type of tiles currently in place (heavily Armstrong)"); AWI00201678 at AWI002019694 (internal Armstrong presentation stating that an Armstrong advantage is "Match existing . . . 45% of US market is patch and match"); GMS 2018 10-K at 4 ("because ceiling tile systems differ in size, shape and aesthetic appeal between manufacturers,

majority of SACT revenue actually comes from these repair-and-replace jobs where customers buy the same brand and model that is currently installed, as opposed to new construction jobs where multiple brands can compete for the job.¹⁶⁷

106. This incontestable demand for Armstrong SACTs gives Armstrong significant market power that it has used in multiple ways. For example, because Armstrong knows that a substantial portion of SACT demand can be satisfied only with Armstrong SACTs, Armstrong can raise prices more without losing as much business. Further, this incontestable demand gives Armstrong the market power to foreclose distributors through exclusive dealing and similar conduct. For example, Armstrong's exclusive dealing agreements require distributors to purchase SACTs exclusively from Armstrong in order to get access to the Armstrong SACTs that they need for the majority of repair-and-replace jobs.

107. Repair-and-replace jobs similarly give USG a significant amount of incontestable demand because USG has historically sold █% of SACT units in both North America and the United States, and consequently about █ of all repair-and-replace jobs are for USG SACTs.

108. **g. High Entry and Expansion Barriers Confirmed by Inability of New Firms to Gain Substantial Shares Despite High Incumbent Profit Margins.** Armstrong has publicly called its North American SACT business a "wonderful profit pool"¹⁶⁸ and earns a high profit margin on SACTs,¹⁶⁹ so if entry

they are often replaced with the same brand for R&R projects. As a result, the leading brand's installed base of product generates built in demand for replacement product over time").

¹⁶⁷ Barker Deposition Exhibit 3 (May 2016 Barron's article titled "Why Armstrong World's Ceilings Are Looking Up") ("60% of revenue comes from replacing damaged or old tiles, a business in which the original supplier needs to match the existing tiles."); ROXUL_0102375 at ROXUL_0102389 (2014 Industry Report by Freedonia. "The improvement and repair markets generate more demand than the new construction markets, as many ceiling products, particularly ceiling tiles, are typically replaced several times over the life of the building in which they are installed for purposes of maintenance and repair or improved interior aesthetics."); USG 2017 10-K at 5 (75% of USG ceiling sales were from repair and remodel activity, 20% were from new nonresidential construction, and 5% from new residential construction).

¹⁶⁸ May 21, 2014 Armstrong Analyst/Investor Day Transcript ("A question we get all the time from investors is, what prevents this mythical Chinese ceiling tile distributor or a manufacturer from moving to the U.S. and poisoning this wonderful profit pool we have?").

¹⁶⁹ Barker Exhibit 4 (investment analysis of AWI by the firm SunTrust Robison Humphrey, dated April 20, 2015) ("By far, AWI's strongest margin results are in the Americas,

and expansion barriers were low one would expect new firms to swiftly enter and obtain significant chunks of the market in order to earn those high profits. But to the contrary, despite many firms attempting to sell SACTs in North America,¹⁷⁰ no new entrant (including Rockfon) has been able to obtain even a 3% share of SACT sales in North America over the past 30 years. Rockfon has been the most successful new entrant in the past 30 years (since CertainTeed entered), and yet has only obtained a 2% share in North America after over four years in the market.¹⁷¹ Nor has Rockfon quickly expanded in regional markets: as of 2017 its share exceeds 5% in only five out of 61 regional markets, exceeds 10% in only one regional market, and was never greater than 30%.¹⁷² Rockfon's inability to obtain a significant share of SACT sales in North America is an especially strong indicator of the high barriers to entry and expansion in North America given that Rockfon's parent company, Rockwool, was able to obtain a 30% market share in Europe while selling similar tiles against Armstrong.¹⁷³

which over the last four years have seen EBITDA margin expand from roughly 30% to 40%+. The market structure is a significant driver of these profits.”). *See also infra* Part C.2, showing that Armstrong is able to increase its SACT prices above its production costs far more than Rockfon.

¹⁷⁰ Examples of smaller firms that have attempted to enter the North American SACT market or have entered but failed to obtain even a 1% market share are: OWA, Top Tile, and Sky Acoustics. Pasquerello (AWI) Deposition at 22 (“Q: Who are the competitors in the ceiling tile space in the United States? A: . . . OWA is a name that comes up from time-to-time. But they’re not really that large a factor.”); Barker (AWI) Deposition at 59-61 (listing Top Tile and Sky Acoustics as two smaller ceiling tile firms). These firms have such small shares of the market that they are generally not individually listed in reports that mention market shares, and instead are grouped together under all “other” besides Armstrong, USG, CertainTeed, and Rockfon. *See, e.g.* May 16, 2016 Analysis of AWI by Jason Marcus of J.P. Morgan, Figure 7 (“North American Ceilings Market share (tile and grid)” Armstrong 55%, USG 30%, CertainTeed 10%, Rockfon 1%, “Others” 4%). This is consistent with Armstrong employee testimony that Armstrong’s primary ceiling tile competitors are USG, CertainTeed, and Rockfon. *See, e.g.,* Lay (AWI) August 14, 2018 Deposition at 29 (“Q: And who are the competitors in the ceiling tile market, excluding specialty, today? A: USG and CertainTeed and Rockfon”); *id.* at 50 (“Q: Roxul, CertainTeed and USG. Are there any other [competitors for AWI in the USA today]? A: Those are the primary ones on ceilings. And then, of course, when you get into the specialties there’s hundreds of them. But on core ceilings, those are the primary ones.”).

¹⁷¹ “ROXARM25 North American SACT Shares.csv”.

¹⁷² “ROXARM65 num region Rockfon Share gtX.csv”.

¹⁷³ AWI00016871 (September 2012 internal Armstrong email stating “Rockfon entered the European market and was able to gain approximately 30% market share in a relatively short period of time.”).

2. Power over Price

109. a. Armstrong Charges Higher Prices Than Its Smaller Rivals.

There is a broad consensus that Armstrong charges higher prices than its smaller rivals. For example, even Armstrong employees have admitted in deposition that Armstrong “typically price[s] at a premium in every market that [Armstrong] serve[s],”¹⁷⁴ and that “Armstrong is generally the high priced manufacturer.”¹⁷⁵

110. Although Armstrong has argued that its prices are higher because its quality is higher,¹⁷⁶ the evidence indicates that Armstrong charges higher prices than its competitors for SACTs of similar quality. An Armstrong employee testified in deposition that if one compares “apples to apples . . . talking about a product with the same attributes,” then Rockfon would be less expensive than Armstrong.¹⁷⁷ Similarly, a third-party report analyzing this market commissioned by Armstrong states that USG is “generally lower priced than Armstrong” even though USG is “also viewed as high quality,” like Armstrong.¹⁷⁸

111. Armstrong and Rockfon price data confirm that Armstrong generally charges higher prices for SACTs of similar characteristics. [REDACTED]

[REDACTED]g
179 The most common version of the Optima sold has an NRC of 0.95 and a CAC of 26. The Rockfon product line most similar to Armstrong’s Optima (high NRC, low CAC) is Rockfon’s Sonar product line, which has an NRC of 0.95 and a

¹⁷⁴ Loufek (AWI) Deposition at 44.

¹⁷⁵ Pasquerello (AWI) July 13, 2018 Deposition at 40.

¹⁷⁶ Armstrong Motion to Dismiss at 9 (“even assuming that Armstrong can charge 5% higher prices than one or more of its competitors, that may simply be an indication of quality.”).

¹⁷⁷ Harold Barker (AWI) Deposition at 210 (“Q: What is the pricing difference between Rockfon and Armstrong with regard to commercial ceiling tiles? A: You would have to compare apples to apples, so we would need to make sure that we’re talking about a product with the same attributes. The Armstrong attributes would equal the Rockfon attributes. My experience has been that Rockfon would be low cost. Q: So Rockfon would be less expensive than Armstrong comparing similar products? A: That would be my experience.”); *id.* at 212 (“Q: Let’s talk about USG and Armstrong. How do they compare on price comparing similar items? A: It would be similar.”)

¹⁷⁸ AWI00019886 at AWI00019891.

¹⁷⁹ [REDACTED]

CAC of 22.¹⁸⁰ Despite both having identical NRCs and similar CACs, Armstrong's Optima was on average \$[REDACTED] per square foot, which is [REDACTED]% higher than Rockfon's average Sonar price of \$1.59 per square foot. Table 6 below summarizes this comparison.

Table 6: Price Comparison for High-NRC, Low CAC Products¹⁸¹				
Manufacturer	Product Line	NRC	CAC	Average Price (\$/ft²)
Armstrong	Optima	0.95	26	[REDACTED]
Rockfon	Sonar	0.95	22	\$1.59

112. The most common version of the Armstrong Ultima sold has an NRC of 0.75 and a CAC of 35. The most similar Rockfon product line is its "Alaska dB" product line, which has a slightly higher NRC (0.85) and the same CAC (35). Even though Armstrong's Ultima provides the same CAC and a *lower* NRC, the Ultima is nonetheless \$[REDACTED] per square foot, which is [REDACTED]% higher than the price of Rockfon's Alaska dB (\$1.08 per square foot). Table 7 below summarizes this comparison.

Table 7: Price Comparison for Medium-NRC, High-CAC Products¹⁸²				
Manufacturer	Product Line	NRC	CAC	Average Price (\$/ft²)
Armstrong	Ultima	0.75	35	[REDACTED]
Rockfon	Alaska dB	0.85	35	\$1.08

113. Similarly, internal Armstrong comparisons of competitors' SACT prices confirm that Armstrong charged higher prices than its competitors for comparable products. Table 8 below reproduces a 2017 internal Armstrong

¹⁸⁰ This is consistent with the testimony of Tom McKinney, AWI's director of pricing for ceiling tiles. McKinney Deposition at 35-36 (testifying that Rockfon's Sonar and Alaska lines were most similar to Armstrong's Optima product line).

¹⁸¹ "ROXARM63 High NRC, Low CAC Price Comparison.csv". Prices for Rockfon and Armstrong are both calculated for 2016 for an apples-to-apples comparison. More generally, the Optima was on average [REDACTED]% more expensive than the Rockfon Sonar from October 2013 (Rockfon purchase of CMC) to September 2017 (end of Roxul PMRS data). "ROXARM63 price comparison 10-2013 to 9-2017.csv".

¹⁸² "ROXARM63 Medium NRC, High CAC Price Comparison.csv". More generally, the Armstrong Ultima was on average [REDACTED]% more expensive than the Rockfon Alaska dB from October 2013 (Rockfon purchase of CMC) to September 2017 (end of Rockfon PMRS data). "ROXARM63 price comparison 10-2013 to 9-2017.csv".

presentation, in which Armstrong identifies the most similar competitive products for four of Armstrong's [REDACTED] product lines (the Cortega (fissured), Dune, Ultima, and Optima lines), and lists the price premium Armstrong charges relative to the competitors' product. The Armstrong price premium over USG and CertainTeed ranges from [REDACTED]% for the lowest-end SACTs to up to [REDACTED]% for the highest end SACTs, which confirms that Armstrong tends to charge higher prices than USG and CertainTeed for comparable products. Further, this Armstrong document shows that it charges an even larger premium over Rockfon's prices, indicating that Armstrong, USG, and CertainTeed all charge higher prices than Rockfon for comparable products. The fact that Rockfon charges lower prices than all three of Armstrong, USG, and CertainTeed is important because it means that foreclosing Rockfon in particular will significantly reduce the constraint on Armstrong's prices and increase marketwide prices, even if USG and CertainTeed remain unforeclosed.

Table 8: Internal Armstrong Estimates of Its Price Premiums Relative to USG, CertainTeed, and Rockfon ¹⁸³					
Armstrong Product	Armstrong AUV	USG/ CertainTeed Product	Armstrong Premium over USG/ CertainTeed	Rockfon Product	Armstrong Premium over Rockfon
Cortega	[REDACTED]				
Dune					
Ultima					
Optima					

114. **b. Armstrong Has Been Able to Elevate Its Prices Above Its Costs More than Rockfon.** Armstrong not only charges higher prices than its smaller rivals, but also is able to elevate its SACT prices more above its costs of production. Here, I have production cost data only for Armstrong and Rockfon. Figure 14 below shows that Armstrong has consistently been able to charge prices that are over [REDACTED] its production costs, whereas Rockfon only charges prices that are [REDACTED] times its production costs. Armstrong's significantly greater ability to

¹⁸³ AWI00226883 at AWI00226889 (May 23, 2017 presentation).

elevate price above its production costs further confirms that Armstrong has market power over price.

Figure 14: Ability to Elevate Price Above Production Cost, Armstrong versus Rockfon¹⁸⁴



115. Armstrong and Rockfon sales data also shows that Armstrong consistently raises its prices above its production costs more than Rockfon across all regional markets within the United States. Figure 15 below shows Armstrong's and Rockfon's average ratios of price to production cost in each of the 61 regions within the United States (each region is a separate point on the horizontal axis). One can see that Armstrong's price-to-cost ratio is always higher than Rockfon's.

¹⁸⁴ "ROXARM69 Price Over Production Cost AWI v Rockfon.csv".

Figure 15: Rockfon and Armstrong Price to Production Cost Ratios, Calculated Separately for Each Price Metro Within the United States¹⁸⁵



116. **c. Armstrong Has Been Able to Raise the Prices of its Ceiling Tiles Above Cost More in the U.S. Than in Other Regions.** Third-party market research reports confirm that Armstrong’s ceilings business has been able to achieve higher profit margins in the U.S. than in other areas of the world. For example, a 2015 market research analysis by the firm SunTrust Robinson stated that, “By far, AWI’s [Armstrong’s] strongest margin results are in the Americas, which over the last four years have seen EBITDA margin expand from roughly 30% to 40%” and that “the market structure is a significant driver of these profits.”¹⁸⁶ By comparison, Armstrong’s EBITDA margins were only 1-2% in Europe, the Middle East, and Africa, and only 2-5% in the Pacific Rim.¹⁸⁷ SunTrust Robinson attributed Armstrong’s higher profit margins in the Americas to its high market share and high barriers to entry in that market: “the business is effectively an oligopoly in the U.S., as AWI [Armstrong] has the leading market share in ceilings, well ahead of the number two player, USG, which has roughly a

¹⁸⁵ “ROXARM69 awi vs rockfon price to cost ratios regional.csv”.

¹⁸⁶ Barker Exhibit 4 (investment analysis of AWI by the firm SunTrust Robison Humphrey, dated April 20, 2015).

¹⁸⁷ *Id.*

35% market share. These two companies really dominate the business.”¹⁸⁸ Similarly, JP Morgan concluded in 2016 that in the U.S. “AWI [Armstrong] will continue to enjoy pricing power in its ceiling business, driven by the industry’s high degree of consolidation as well as negligible amounts of imports,” and noted that “AWI [Armstrong] has pointed to strong incremental EBITDA margins in North America of roughly 60%.”¹⁸⁹

3. Power to Exclude Rivals

117. Evidence that a firm has been able to successfully exclude rivals directly proves that the firm has market power because only firms with market power can profitably exclude rivals. Here, there are many different types of evidence showing that Armstrong and USG have successfully foreclosed smaller rivals such as Rockfon, and thus that they have market power. For example, I show below in Part III that: (1) Armstrong (both on its own and in combination with USG) has foreclosed significant shares of the relevant markets; and (2) Rockfon grows significantly slower among foreclosed customers.

D. Rockfon Is a Market Maverick

118. The evidence indicates that Rockfon is a “maverick” competitor in the SACT markets, which makes foreclosure of Rockfon in particular especially harmful to competition. In economics, a “maverick” firm is one that provides a unique competitive constraint on the market, for example by pricing more aggressively than other firms or by offering unique products. Thus, “maverick” firms disrupt markets to the benefit of consumers, and economists recognize that eliminating competition from these “maverick” firms can significantly harm competition.¹⁹⁰ Here, I discuss two ways in which Rockfon is a “maverick” SACT

¹⁸⁸ *Id.*

¹⁸⁹ Barker Exhibit 5 (JP Morgan investment analysis of AWI, dated May 16, 2016) at 2.

¹⁹⁰ DOJ/FTC Horizontal Merger Guidelines §2.1.5 (2010) (“The Agencies consider whether a merger may lessen competition by eliminating a ‘maverick’ firm, i.e., a firm that plays a disruptive role in the market to the benefit of customers. For example, if one of the merging firms has a strong incumbency position and the other merging firm threatens to disrupt market conditions with a new technology or business model, their merger can involve the loss of actual or potential competition. Likewise, one of the merging firms may have the incentive to take the lead in price cutting or other competitive conduct or to resist increases in industry prices. A firm that may discipline prices based on its ability and incentive to expand production rapidly using

competitor: (1) Rockfon prices more aggressively than other firms; and (2) Rockfon offers unique products. Indeed, Armstrong's contract terms with FBM and GMS that prohibit non-Armstrong locations from carrying Rockfon in particular (but allow those same locations to carry CertainTeed or USG) would be economically rational only if Armstrong believed that Rockfon posed a competitive constraint that USG and CertainTeed did not.

1. Rockfon Prices More Aggressively

119. As shown above in Part I.C.2, Armstrong, USG, and CertainTeed all charge higher prices than Rockfon for similar products. Moreover, the evidence indicates that Armstrong, USG, and CertainTeed engage in extensive price coordination in which they follow each other's price increases instead of competing aggressively against each other on price.¹⁹¹ Because USG and CertainTeed price higher than Rockfon and tend to follow Armstrong's price increases, competition from USG and CertainTeed does not constrain Armstrong's prices as much as competition from Rockfon does.

available capacity also can be a maverick, as can a firm that has often resisted otherwise prevailing industry norms to cooperate on price setting or other terms of competition.”).

¹⁹¹ McKinney (AWI Director of Pricing for Ceiling Tiles) Deposition at 75-76 (“Q: . . . Is Armstrong the price leader in the ceiling tile market in the U.S.? A: We certainly expect to get a premium for the product. Q: And when Armstrong makes a price increase, does USG usually follow? A: They do. Q: Does CertainTeed usually follow? A: They do. Dates are staggered in different amounts, depending on their internals. Q: Does Rockfon usually follow? A: I’ve seen less consistent evidence that I have. I don’t know if they follow”); AWI01159944 (“We believe USG & CT will follow suit if we do so”, regarding Price Increases); Hart Deposition Exhibit 4, page 2 (internal Rockfon document surveying the competition. Under Armstrong, it states “Price leader – transparent about the fact that its prices will go up – and the market will follow”); Barker Exhibit 4 (investment analysis of AWI by the firm SunTrust Robinson Humphrey, dated April 20, 2015) (“We believe in ceilings, business price gains have been the norm at USG versus price cutting, thus resulting in the gains in margins. . . . Said another way, USG stopped trying to be the largest, opting instead to be a ‘very profitable #2’. The result was substantial gains in profitability for both producers as shown on this page.”); AWI00773084 (internal Armstrong email [REDACTED]).

2. Rockfon Offers Unique Products

120. Rockfon is a “maverick” also because it introduced unique products to North America. In particular, Rockfon introduced mid-to-high NRC SACTs with smooth white finishes at lower prices than Armstrong’s smooth-finished SACTs.¹⁹²

121. In response to Rockfon introducing smooth-finished, high-NRC, lower-cost tiles to North America, Armstrong had to develop new SACTs that it called its “defensive products.”¹⁹³ Armstrong’s new defensive products were: (1) the “Playa,” which was designed to compete with Rockfon’s “Pacific” product; (2) the “Yukon,” which was designed to compete with Rockfon’s “Artic” product; and (3) the “Dakota,” which was designed to compete with Rockfon’s “Koral” and “Tropic” products.¹⁹⁴

[REDACTED]

[REDACTED]

122. Internal Armstrong documents show that [REDACTED]

[REDACTED]

¹⁹² AWI00961128 at AWI00961134 (“[Rockfon] Products targets our gaps. Rockfon is trying to target perceived gaps in the Armstrong product line. High end fiberglass and mineral fiber specifically. We have limited their effort with new product launches such as Calla and Lyra which will give the clean smooth visual our customers are asking for”); AWI01218925 at AWI01218926 (“Problem: 1) Rockfon is showing up in specification with High NRC / Low CAC smooth, white panels. . . 2) Rockfon is coming after projects where Optima, Calla, or Ultima is specified and offering savings to the contractor or GC. Solution: Armstrong defensive products offer a smooth, white laminated visual on a mineral fiber or fiberglass substrate with high NRC”).

¹⁹³ McKinney Deposition at 174 (“Q: . . . is the reason [defensive products] were developed in direct response to Rockfon’s entry into the market? A: That is my understanding”); AWI01218905 at AWI01218918 (“What is our general value proposition for defensive products? Smooth, White Laminated visual. Good NRC performance”).

¹⁹⁴ AWI01218925 at AWI01218926.

¹⁹⁵ [REDACTED]

[REDACTED]

¹⁹⁶ McKinney Deposition at 173.

¹⁹⁷ AWI01218905 at AWI01218918 (“[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

123. Because Armstrong [REDACTED]
[REDACTED]: (1) deprives that customer of the ability to use Rockfon's innovative SACTs; (2) deprives that customer of the ability to use Armstrong's defensive products designed in response to Rockfon's SACTs; and (3) will cause the customer to pay higher prices for Armstrong's standard products rather than Rockfon's lower-priced SACTs or Armstrong's defensive products.

124. Given that only competition from Rockfon (as opposed to USG or CertainTeed) forces Armstrong to offer customers less expensive "defensive" products with lower profit margins, it is not surprising that Armstrong would try to foreclose Rockfon in particular from competing. When Armstrong only has to compete against USG or CertainTeed, there is no need to use defensive products and therefore Armstrong can continue to earn higher profit-margins on its standard products. In the next Part of this report, I describe the multiple ways in which Armstrong foreclosed Rockfon.

II. OVERVIEW OF CONDUCT RESTRAINING RIVALS

125. Armstrong and USG have engaged in multiple types of conduct that restrained distributors from buying or selling SACTs from rival manufacturers. For example, Armstrong has entered into agreements with some distributors that explicitly prohibit the distributors from carrying or reselling any ceiling products made by rival manufacturers. I describe the various ways in which Armstrong and USG have foreclosed rivals from access to distributors in sections B-F below. Before doing so, I first discuss in section A why foreclosing rivals from access to distributors restrains the ability of rivals to effectively compete.

A. Why Distributor Foreclosure Restrains Competition

126. Preventing rival manufacturers from selling to distributors forecloses not only the primary purchasers of SACTs, but also the most efficient means of distribution. As I showed above in Part I.C.1 (barriers to entry), SACT manufacturers sell the vast majority of their SACTs through distributors because

distributors offer many efficiencies over direct-purchase that most contractors desire.

127. The brands of SACTs carried by a distributor influences which SACT model is used on a particular job in the following two ways:

(a) **First, contractors typically will include a SACT brand in its bid for the job only if the contractors' preferred distributor carries that SACT brand.** Multiple types of evidence show that the brands that a contractor's favored distributor carry strongly influences which SACTs the contractor will include in its bids.¹⁹⁸ For example, a survey commissioned by Armstrong of contractors indicated that the two most important factors in determining their "preferred brand" of SACT were price and "availability and service from the distributor or dealer you [the contractor] prefer."¹⁹⁹ Similarly, when these surveyed contractors were asked open-endedly which factors drive their preference for a particular brand, many responded that distributor availability was the most important factor, stating, for example "Number 1 is our supplier," and "the main thing [is] the service I get from my distributor", or "having the distributor have the product in stock."²⁰⁰ Similarly, a Rockfon employee testified that contractors "generally will have a relationship with distributors on other products" and therefore the SACTs the contractors' preferred distributor has available is "extremely important" to the

¹⁹⁸ Lay (AWI) August 14, 2018 Deposition at 87 ("Q: Contractors can be loyal from distributor to distributor? A: Yes, they can. Q: Can have long-standing relationships with those distributors? A: They can. Or they could have a long-standing issue with your particular distributor, so they want a choice.").

¹⁹⁹ AWI00019892, "Contractor" tab (survey of 12 contractors commissioned by Armstrong and performed by Sterling Associates. Rows 102-107 ask the contractors to rate "some factors [Sterling Associates] thought might be important to contractors in determining their preferred brand" on a scale of 1-5 (with 5 being most important, 1 being least important). The two most important factors were "lowest price for product" (average score of 4.4/5) and "availability and service from the distributor or dealer you prefer" (average score of 4.3/5). The other factors were "relationship and service from the company's rep" (average score 3.7/5), "easier to install" (average score 3.2), and "acceptance in the market – viewed as industry standard, most often specified (average score 3.2)).

²⁰⁰ AWI00019892, "Contract" tab (survey of 12 contractors commissioned by Armstrong and performed by Sterling Associates. Row 99 asks "What factors drive your preference, as a contractor, for one brand over another? What is most important to you as a contractor?" Several responses mentioned distributors or delivery service, e.g. "Number 1 is our supplier. Are they going to get the material on-time", "the service that I get from my distributor. That's pretty important, the main thing," "I would say service, delivery, then price," "the way I like to guide this business is service and having the distributor have the product in stock.").

decision about which SACT to use.²⁰¹ Consequently, if Armstrong prohibits a distributor from carrying other SACT brands, then the contractors who prefer that distributor generally will not include rival SACT brands in their bids.

(b) Second, distributors' sales forces influence which brands of SACTs the contractor will include in its bids. Many building products distributors have specialized sales forces that are trained to sell the particular brands of SACTs that the distributor carries.²⁰² As one analyst put it, distributors provide "a sales value" to manufacturers and "are in touch with the decision makers on commercial projects to get their products specified for the job."²⁰³ When Armstrong's agreements prevent the distributor from selling rival SACTs, the distributors' sales force will in turn attempt to convince contractors to use only Armstrong brands, regardless of which brand of SACT would actually be most appropriate for the particular job. In contrast, when distributors are free to carry and sell multiple SACT brands without any restraints, the distributors' sales force are incentivized to instead to recommend the brand and model of SACT that will best suit the project and thus give the contractor the best chance of winning the bid.

128. Ultimately, multiples types of evidence show that the SACT brands distributors carry significantly affects which SACTs are actually purchased and used in projects: (a) the widespread consensus among industry participants and analysts that access to distributors is crucial and poses a barrier to entry to rival SACT manufacturers;²⁰⁴ (b) Armstrong's significant efforts to prevent rivals, and in particular Rockfon, from gaining access to distributors, which would be economically rational only if restricting rival access to distributors gave Armstrong

²⁰¹ Nevins (Roxul) Deposition at 87 ("Q: What are the primary factors for a contractor in choosing a ceiling tile? A: I would say weight, cutability. In many cases it's – for a contractor it's extremely important the distributor that carries that, because they generally will have a relationship with distributors on other products").

²⁰² FBM 2017 10-K at 3 ("For ceiling contractors, we carry a wide range of products and have the technical sales expertise to assist our customers in selecting the appropriate acoustical product for their project"); McCatty Deposition at 28 ("Q: Do you think distributors have an influence on what ceiling tiles are used on particular jobs? A: Yes. Q: And is that based on the influence distributors have with their contractors? A Yes.").

²⁰³ Barker Deposition Exhibit 4 (investment analysis of AWI by the firm SunTrust Robinson Humphrey, dated April 20, 2015) at 12 ("Distribution a Barrier but Rockwool Makes Push into U.S. Ceilings. Armstrong sells its products through third party distributors who provide both an inventory and, more importantly, a sales value in the value chain. These distributors are in touch with the decision makers on commercial projects to get their products specified for the job.").

²⁰⁴ See *supra* Part I.C.1.

a competitive advantage; and (c) explicit statements by industry analysts that distributors affect the choice of SACT used on a job.²⁰⁵

129. Nonetheless, Armstrong has argued in its Motion to Dismiss that foreclosing distributors (as opposed to end-users, who are the contractors in this case) does not actually foreclose rival SACT manufacturers for various reasons. Below, I show why each of these arguments is mistaken.

130. **a. Selling Directly to Contractors Instead of Distributors Is Not Efficient for the Majority of Sales.** Armstrong has argued in this case that preventing distributors from selling rival SACTs does not foreclose rival SACT manufacturers based on the premise that SACT manufacturers can alternatively sell directly to contractors.²⁰⁶ Armstrong's premise that SACT manufacturers could simply switch to selling directly to contractors is mistaken because most contractors are not able to efficiently self-supply distribution services. Armstrong employees have testified that, in order for contractors to self-supply distribution services, they would at the very least need warehouses and a fleet of trucks,²⁰⁷ which are investments that would be profitable only if the contractor was particularly large. Further, even if a contractor had a warehouse and trucks, it could not self-supply many of the other services that distributors provide, such as one-stop shopping and better credit terms than manufacturers offer. Indeed, sales shows that SACT manufacturers sell only 9% of their SACTs directly to contractors, which directly shows that direct purchasing is usually not the most efficient means of selling SACTs.²⁰⁸ Third-party reports likewise acknowledge that selling SACTs directly to contractors is not a "sustainable strategy."²⁰⁹

²⁰⁵ Barker Deposition Exhibit 4 (investment analysis of AWI by the firm SunTrust Robinson Humphrey, dated April 20, 2015) at 12 ("distributors are in touch with the decision makers on commercial projects to get their products specified for the job."). *See also* Lay (AWI) August 14, 2018 Deposition at 86 ("Q: Having a strong distributor partner in any territory would be key to growing and maintaining market share? A: Yes").

²⁰⁶ Armstrong Motion to Dismiss at 12.

²⁰⁷ Loufek (AWI) Deposition at 79 ("Q: Wouldn't there also be just some minimum requirements of that contractor [to be a direct purchaser]? I know you mentioned size. But they would need to have storage facilities, right, trucks to deliver the product on-site? A: Correct.").

²⁰⁸ "ROXARM17 SACT Sales 2014-2017 by cust_group (ARM, USG, Rockfon).csv".

²⁰⁹ AWI00009000 at AWI0009003 ("What is the impact of Rockfon selling direct to contractors? Rockfon in 2017 has been focusing on going directly to contractors to sell products. Will this be a sustainable strategy? We think not, as ceiling tile primarily is sold through the distribution network for a reason. If general contractors had to negotiate pricing for each individual building product used in a construction project, this would further exacerbate the already challenging bottlenecks in the construction process. No one has asked the 'why?' behind

131. **b. Existence of Some Unforeclosed Distributors Does Not Negate Foreclosure of Other Distributors.** Armstrong has also argued that preventing distributors from selling rival SACTs does not foreclose rival SACT manufacturers based on the premise that SACT manufacturers can alternatively sell through unforeclosed distributors.²¹⁰ Armstrong's argument is mistaken for multiple reasons.

132. *First*, total foreclosure of 100% of a market is not necessary for anticompetitive harm.²¹¹

133. *Second*, Armstrong's argument ignores that contractors have developed relationships with (and sometimes loyalty to) particular distributors,²¹² and consequently that foreclosing rivals from access to a particular distributor also effectively forecloses rivals from the contractors that have developed relationships with that distributor.

134. *Third*, Armstrong's argument ignores that distributor quality and expertise varies significantly, meaning that foreclosing rivals from access to the best distributors impairs rivals' ability to compete even if rivals still have access to lower-quality distributors. For example, because Armstrong and USG have foreclosed access to most of the specialty ceilings products distributors, Rockfon

this direct-to-contractor strategy Rockfon is attempting. In our opinion, because Rockfon has faced greater than anticipated challenges to gaining a foothold with key distribution relationships and likely isn't receiving the support they would like, the company is choosing to go direct to contractors. . . . History has shown that significant ceiling industry market share shifts take a long time to achieve, and given the steep distributor barriers to entry, we think it will be very challenging for Rockfon to gain market share in the near term.") (underlines in original).

²¹⁰ Armstrong Motion to Dismiss at 12.

²¹¹ ELHAUGE, U.S. ANTITRUST LAW & ECONOMICS 371 (3d ed. 2018) ("The major anticompetitive concern is that [exclusive dealing] agreements might foreclos[e] enough of the market to rivals as to impair competition."); *id.* at 408-09 (the conclusion that "foreclosure need not be total . . . fits the relevant economics because the possible anticompetitive effects depend on the extent to which rival sales were restrained, not on whether the foreclosure was total at any particular distributor or end-user.")

²¹² Lay (AWI) August 14, 2018 Deposition at 87 ("Q: Does adding additional distributors equate to additional market share? A: It can. It doesn't always determine success, but it actually gives you an opportunity to perhaps sell some of the customers that you're not currently selling that might be – have a relationship with an existing distributor. Q: Contractors can be loyal from distributor to distributor? A: Yes, they can. Q: Can have long-standing relationships with those distributors? A: They can. Or they could have a long-standing issue with your particular distributor, so they want a choice.").

has been forced to attempt to sell its SACTs through distributors of insulation products, who lack sales forces with specialized knowledge about SACTs and relationships with ceiling contractors (as opposed to insulation contractors).²¹³ An Armstrong employee has also testified that some distributors are “not very effective” as compared to others, for example because they do not provide all of the “functions expected by the contractors who do business with a distributor.”²¹⁴ This same Armstrong employee testified that not having a “top quality distributor” makes it harder to sell SACTs,²¹⁵ confirming that restricting Rockfon from access to the best distributors impairs Rockfon’s ability to compete even if Rockfon still has access to some inferior distributors.

135. **c. Architect Specifications of Which SACTs Are Acceptable Does Not Negate the Foreclosure of Distributors.** Armstrong has also argued that preventing distributors from selling rival SACTs does not foreclose rival SACT manufacturers based on the premise that architects “specify the brand and performance of the [SACT] in at least 90% of interior construction projects,” and that architects were not foreclosed.²¹⁶ This argument falsely implies that the architect specifies only a single acceptable brand on 90% of jobs, when in reality the evidence indicates that architects usually specify multiple acceptable brands by

²¹³ Noeth (Rockfon) Deposition at 205-206 (“Q: Has Rockfon built any distributors from scratch? A: We have not built any distributors. We have distributors that, when we get kicked out of somewhere, we end up having to start somewhere else, and those restarts have been, a lot of times, with folks that don’t really know ceilings that well and we try to build them up. Q: Is IDI an example? A: IDI is an example of –yeah, a company that was mostly insulation-focused, would not be our idea of an ideal ceilings distributor, but if you look at the markets where we operate with them, it was probably because that was our only option after the changes that were forced on us through the Armstrong pressures”).

²¹⁴ Galvin (Armstrong) Deposition at 164-165 (testifying that Armstrong terminated a distributor named [REDACTED] because “they were not very effective,” explaining that “there are certain functions expected by the contractors who do business with a distributor that Lensing just flat out would not provide,” such as unloading the products for the contractor).

²¹⁵ Galvin (Armstrong) Deposition at 166 (“Q: And by having not a top quality distributor, did that make it harder for you to sell Armstrong ceiling tiles? A: Absolutely.”).

²¹⁶ Armstrong Motion to Dismiss at 13 (“competition in the ceiling tile market is rooted in the specification process, whereby “[a]rchitects specify the brand and performance of Ceiling Tile or Grid System (‘spec’) in at least 90% of interior construction projects. Thus, ... here the decision to specify remains in the hands of the consumer, that is, the architect who could choose Rockfon. Rockfon does not allege that Armstrong’s exclusive agreements with distributors prevent Rockfon from lobbying for or selling its products at the specification phase. There is, therefore, no foreclosure because Rockfon remains able to compete for the ultimate consumer in at least 90% of interior construction projects.”).

name or specify that any SACT with “equal” performance is acceptable.²¹⁷ Indeed, industry participants have estimated that 50-75% of specifications include “or equal,” which “allows the contractor to influence brand selection.”²¹⁸ Thus, architect specifications generally allow contractors to use multiple brands of SACTs, but Armstrong’s restrictions on distributors prevent them from carrying all of the brands that architects view as acceptable.

136. **d. The Significant Incontestable Demand for Replacement Armstrong SACTs Prevents Rockfon From Competing for Exclusive Agreements With Distributors Against Armstrong.** Armstrong has also argued that its exclusive dealing agreements with distributors do not foreclose Rockfon based on the premise that Rockfon could compete for exclusive distributor agreements against Armstrong.²¹⁹ This argument fails to account for the fact that there is significant incontestable demand for Armstrong SACTs. As I discussed above in Part I.C.1, a majority of SACT purchases are for replacing damaged or old tiles, and customers generally demand that the original brand and model be used so that it matches the existing tiles. Because Armstrong has sold over 50% of SACTs in North America for many years, most of these replacement jobs are for Armstrong tiles. Consequently, at least 25% of SACT sales are for repairing or replacing Armstrong tiles and can be satisfied only by Armstrong tiles. This means a distributor would automatically disqualify itself from about 25% of all SACT jobs if it rejected an exclusive agreement with Armstrong and instead signed an agreement with a rival. In contrast, if Armstrong did not use exclusive dealing agreements, distributors would be free to purchase any other manufacturers’ SACTs for the 75% of the distributors’ business that is not the repair and/or replacement of Armstrong SACTs.

²¹⁷ See, e.g., AWI00019892, “Architect” tab (survey of architects commissioned by Armstrong and performed by Sterling Associates. Row 36 asks “How do you typically write the specs for ceiling tile? A single brand? Brand or equivalent?” Out of thirteen architects surveyed, 2 responded “Usually specify a single specific brand, 2 responded “usually specify a single specific brand ‘or equivalent,” 7 responded “usually specify multiple acceptable brands by name,” and 2 responded that there was no “typical” way to write the specs, and it instead varied case by case. Thus, out of the 11 architects who stated they had a “typical” method of specifying ceiling tiles, only 2 (18%) stated that they usually specify a single brand).

²¹⁸ Hart Deposition Exhibit 4 at page 2 (“Term: ‘or equal’ – more than 50 percent of the time (~75%), specs include ‘or equal,’ which refers to comparable performance. Allows the contractor to influence brand selection.”).

²¹⁹ Armstrong Motion to Dismiss at 14 (“rivals can compete for distributors with expiring or terminable contracts”).

B. Armstrong Prohibited Even Non-Armstrong Distributor Locations from Buying Rockfon

137. Many SACT distributors are owned by larger companies such as FBM and GMS that own multiple distributor locations throughout the country. Most of the distributors owned by these larger companies exclusively sell Armstrong SACTs, and Armstrong's agreements with these distributors included Armstrong's standard contract terms prohibiting any of these "Armstrong locations" from buying SACTs from *any* rival manufacturers, as I describe in more detail in the next section.

138. However, some of the other distributor locations owned by these larger companies do not sell Armstrong SACTs at all and instead sell other distributors' SACTs. Shortly after Rockfon acquired CMC in October 2013, Armstrong entered into agreements with many of the larger companies (such as FBM and GMS) that prohibited all of their "non-Armstrong locations" (i.e., locations distributing SACTs besides Armstrong) from purchasing SACTs from Rockfon in particular. Thus, these Armstrong agreements actually foreclose Rockfon even at FBM and GMS distributor locations that do not sell Armstrong SACTs.²²⁰

139. **a. GMS Agreement.** In March 2014, Gypsum Management and Supply ("GMS") changed ownership and therefore had to obtain Armstrong's consent to continue its distribution relationship with Armstrong, pursuant to its previous agreement. Armstrong provided this consent only if the existing agreement between GMS and Armstrong was amended as follows:

"Distributor agrees not to purchase for resale at any [Armstrong locations], ceiling products of any type directly from any manufacturer other than Armstrong.

As for all other distribution locations owned or operated by [GMS] but not authorized to distribute Armstrong Ceiling Products under this agreement 'Non-Armstrong Locations'), [GMS] agrees that none of them will purchase for resale, directly or indirectly, any ceiling products manufactured by Rockfon. . . provided the foregoing

²²⁰ AWI00066845 (October 24, 2013 email from Paul Corr at Armstrong, "We have the commitment form the largest distributors to avoid them even in markets where they have no line.").

restriction does not apply to products of Chicago Metallic Company or the mineral fiber insulation products of Roxul Inc.

In the event of a breach of this Paragraph 3, Armstrong may, in its sole discretion,

- (a) terminate this Agreement for cause,
- (b) terminate for cause the authority of Distributor to distributor Ceiling Products in all or part of any non-exclusive Territory. . .
- (c) convert for cause, from exclusive to non-exclusive, any exclusive Territory.”²²¹

140. Thus, this agreement allowed Armstrong to terminate its distribution relationship with any (and every) GMS location if even a single GMS location purchased SACTs from Rockfon. As with the FBM agreement, the specific prohibition against Rockfon SACTs applied to non-Armstrong locations, meaning that even GMS locations that were not buying Armstrong SACTs were prohibited from buying Rockfon SACTs.

141. This agreement with GMS stunted Rockfon’s growth by depriving it of crucial distributors when GMS would acquire distributors that were previously buying Rockfon SACTs. I describe examples of these in Part III.C below.

142. **b. FBM Agreement.** In October 2013, FBM acquired the previously independent²²² distributor Home Acres Building Supply (“HABS”) in Grand Rapids, Michigan. Armstrong’s previous agreement with HABS required HABS to obtain consent from Armstrong in order to continue its relationship in the event that HABS changed ownership.²²³ Armstrong consented to the change of ownership of this distributor location from HABS to FBM, but only on the following condition:

²²¹ AWI00619437 at AWI00619437-38. Because this agreement was an amendment to Armstrong’s prior agreement with GMS, the terms of the agreement stating that Armstrong can terminate “this Agreement” mean that Armstrong can terminate its entire agreement with GMS (affecting every GMS location).

²²² By “independent,” I mean this distributor was not previously owned by a larger company that owns many distributors, such as FBM or GMS.

²²³ AWI00069890 at AWI00069892 (agreement between Armstrong and HABS, effective July 24, 2009. “18. This Agreement is not assignable or otherwise transferable by Distributor without the written consent of Armstrong. ‘Assignment’ or ‘transfer’ includes any change in ownership or control of Distributor deemed significant by Armstrong.”)

“In the event that FBM . . . or any affiliate or subsidiary . . . enters into an agreement to purchase ceiling products directly from Rockfon . . . , then Armstrong may, in its sole discretion and in addition to other remedies,

(a) terminate the Agreements and any other agreements between Armstrong and . . . FBM. . .

and/or,

(b) terminate or modify any territory rights under the Agreements and any other agreements between Armstrong and . . . FBM . . . , including but not limited to, any exclusivity rights thereunder”²²⁴

143. Thus, this agreement allowed Armstrong to terminate *all* of its agreements with every FBM distributor location if even a single non-Armstrong distributor location purchased directly from Rockfon. Further, this agreement meant that Armstrong could terminate all of its agreements with every FBM location if any distributor locations FBM acquired later directly purchased from Rockfon.

144. This agreement with FBM significantly stunted Rockfon’s growth in multiple regional markets. On multiple instances, FBM acquired independent distributors that had previously begun buying Rockfon tiles and distributing the region. After FBM acquired these distributors, they became bound by this agreement to stop buying Rockfon tiles and distributing them to the region, which significantly impaired Rockfon’s ability to compete in that region. I discuss several examples of this in Part III.C, below.

145. **c. Interior/Exterior Agreement.** Interior/Exterior Building Supply owns 23 distributor locations throughout the United States.²²⁵ In July 2014, Interior/Exterior entered into a distribution agreement with Armstrong. This agreement included the following section:

“Distributor agrees not to purchase for resale at any [Armstrong location], ceiling products of any type from any manufacturer other than Armstrong.

²²⁴ AWI01015645 at AWI01015646. This agreement was “deemed to amend” all other agreements between FBM and Armstrong. *Id.*

²²⁵ See www.interiorexterior.net/locations-all-interior-exterior-drywall-products.html (listing locations).

For all . . . ‘Non-Armstrong Locations’ that are owned or operate by . . . Distributor . . . Distributor agrees . . . that none of them will purchase any Rockfon ceiling products for resale.

In the event Distributor, its owners, successors, or affiliated companies breach the agreements in this paragraph . . . , Armstrong may, in its sole discretion,

- (a) terminate this Agreement or any other distribution arrangement with any of them for cause
- (b) terminate for cause the authority to distribute Ceiling Products in all or part of any non-exclusive Territory, and
- (c) change to non-exclusive distribution any or all of any exclusive distribution Territory”²²⁶

146. Thus, this agreement allowed Armstrong to terminate its distribution agreements with any (and every) Interior/Exterior location if a single Interior/Exterior location purchased Rockfon SACTs for resale, even for locations that were not authorized to sell Armstrong SACTs.

147. **d. Similar Agreements with ISI, JP Hart, and Westmont Interior Supply House.** Armstrong entered in similar distribution agreements with ISI, JP Hart, and Westmont Interior Supply House, all of which included the language stating that none of their “Non-Armstrong Locations” “will purchase any Rockfon ceiling products for resale.”²²⁷

148. **e. Similar Oral Understandings.** There is also evidence that Armstrong had oral understandings with other distributors that Armstrong would terminate their distribution agreements if they purchased or supported Rockfon in non-Armstrong locations. Joseph Kirkpatrick, the general manager of the CEMEX, a company that owns multiple distributors throughout the southeastern United States, testified in deposition that Paul Corr at Armstrong told CEMEX “do not support Rockfon or it could jeopardize your relationship with Armstrong,” and

²²⁶ AWI00069825 at AWI00069826.

²²⁷ AWI01706555 at AWI01706557 (August 14, 2015 agreement between Armstrong and ISI following ISI’s purchase of Ceiling Systems Distributors. “For all . . . ‘Non-Armstrong Locations’ . . . , Distributor agrees . . . that none of them will purchase any Rockfon ceiling products for resale.”); AWI01205042 at AWI01205043 (3/3/2014 JP Hart agreement “For all . . . ‘Non-Armstrong Locations’ . . . Distributor agrees . . . that none of them will purchase any Rockfon ceiling products for resale”); AWI00070312 at AWI00070313 (11/14/2014 Westmont Interior Supply House Agreement. “For all . . . ‘Non-Armstrong Locations’ . . . Distributor agrees . . . that none of them will purchase any Rockfon ceiling products for resale”).

that CEMEX understood Paul Corr to mean that Armstrong would terminate its agreements with CEMEX if it purchased Rockfon even in locations where CEMEX was not authorized to sell Armstrong SACTs.²²⁸

149. **f. Prohibiting Even Distributor Locations That Do Not Sell Armstrong From Selling Rockfon Evinces Anticompetitive Purpose.** The fact that these Armstrong agreements restrict distributor locations from purchasing from a particular rival (here Rockfon) even when those distributor locations do not purchase from Armstrong is unequivocally anticompetitive. Because Armstrong does not sell any SACTs to these distributor locations, these restrictions by definition cannot be justified as necessary to induce procompetitive Armstrong investments in those distributors or Armstrong price reductions to those distributors. In other words, prohibiting non-Armstrong distributor locations from buying SACTs from Rockfon could be profitable for Armstrong only if this prohibition had the anticompetitive effect of reducing Rockfon's ability to compete against Armstrong for market share and constrain Armstrong's prices. Indeed, I show below that prohibiting non-Armstrong distributor locations from buying SACTs from Rockfon (in combination with other exclusionary agreements) did in fact significantly impair Rockfon's ability to compete, which did in turn allow Armstrong to maintain its dominant market share despite charging supracompetitive prices.

C. Armstrong Agreements Prohibiting Dealers from Carrying Any Rival Ceiling Products

150. Approximately █% of Armstrong's sales to distributors are made under agreements that prohibit them from carrying any rival ceiling products.²²⁹

151. For example, in 2006 Armstrong entered into an agreement with the distributor Ceiling Supply (which has locations in Missouri and Illinois) in which

²²⁸ Joseph Kirkpatrick (General Manager CEMEX) December 14, 2017 CEMEX litigation Deposition at 342 - 343 ("Q: You testified about a meeting that you attended where Paul Corr was there, and I think you said it was out of the ordinary? A: Yes, it was. It was one of our annual big business plan meetings, and he came and attended. Q: And at this meeting, you said there was some discussion about Rockfon coming into the market? A: Yes. Q: What was the discussion? A: The discussion was basically do not support Rockfon or it could jeopardize your relationship with Armstrong. [...] Q: When he made those comments, what did you understand him to be saying? A: Saying that if we were to purchase Rockfon anywhere in our company, not in our market but in our entire company, that we could be terminated with the product line.").

²²⁹ "ROXARM75 pct of AWI Distributor Sales Under Cannot Carry Rivals.csv".

Ceiling Supply agreed that it cannot “carry or resell any other competing ceiling products.”²³⁰ Similarly, in 2014 Armstrong entered into an agreement with the distributor JP Hart Lumber Company, in which the distributor agreed that it “agrees not to purchase for resale at any Distributor Location listed . . . ceiling products of any type from any manufacturer other than Armstrong.”²³¹ These explicit exclusive dealing agreements by definition foreclose Rockfon from access to these distributors.

D. Armstrong Agreements Prohibiting Distributors from Purchasing Ceiling Products Directly from Rival Manufacturers

152. About █% of Armstrong sales to distributors are made under agreements that prohibit the distributor from directly purchasing ceiling products from any rival manufacturers.²³² There is no overlap between this set of distributors who are prohibited from purchasing ceiling products directly from rivals and the distributors described in the prior section who are prohibited from carrying any rival ceiling products. Thus, █% of Armstrong sales (██████████) are to distributors who either have provisions preventing them from purchasing from rivals at Armstrong locations or provisions banning direct purchasing from rivals.²³³

153. The standard language appearing in Section 4 of these Armstrong distributor agreement is: “Distributor . . . will not have a direct buying relationship with any other manufacturer of competing ceiling products.”²³⁴ In addition, later sections of these agreements explicitly state that “having a direct buying relationship with any other manufacturer of competing ceiling products” constitutes a “breach” of the agreement that entitles Armstrong to terminate the agreement for cause.²³⁵

²³⁰ AWI00069546.

²³¹ AWI01205042 at AWI01205043.

²³² “ROXARM75 pct of AWI Distributor Sales Under Cannot Direct Buy Rivals.csv”.

²³³ All but one of the distributors that have provisions banning even their non-Armstrong locations from carrying Rockfon (i.e., those discussed in Section B above) either have provisions preventing them from purchasing from rivals at Armstrong locations (i.e., those discussed in Section C) or provisions banning direct purchasing from rivals (i.e., those discussed in Section D).

²³⁴ See, e.g., AWI00069524 (2006 agreement between Armstrong and Ceiling Systems).

²³⁵ *Id.* at AWI00069527 (“In addition to any other remedy, in the event of a breach of this Agreement by Distributor that is deemed material by Armstrong, Armstrong may give written notice of the breach to the Distributor terminating the Agreement for cause. Without limitation,

154. Prohibiting distributors from buying SACTs and grids directly from rivals significantly restrains rival sales. Although this contract term technically would allow a distributor to purchase rival SACTs from some other distributor that was free to purchase rival SACTs directly from rival manufacturers, in practice distributors rarely purchase products from other distributors.²³⁶

155. Distributors rarely purchase SACTs from other distributors (instead of directly from manufacturers) primarily because it is significantly more expensive to purchase rival SACTs from another distributor instead of directly from the rival manufacturer. Distributors must charge some amount above the price they pay the manufacturer to earn a profit, and here the evidence indicates that SACT distributors sell SACTs for about 12-29% more than the price they paid the manufacturer to purchase the SACT.²³⁷ Thus, prohibiting distributors from purchasing SACTs directly from rival manufacturers artificially increases the price those distributors pay for rival SACTs by 12-29%. This artificial increase in price of rival SACTs effectively prevents the foreclosed distributor from profiting in any significant way by selling rival SACTs. If the distributor increases its prices to account for the increased cost of purchasing rival SACTs, its prices will be higher than distributors who purchase rival SACTs directly from manufacturers and consequently few-to-no contractors will buy rival SACTs from the foreclosed distributor. Conversely, if the foreclosed distributor charges the same prices as the distributors who can buy the rival SACTs directly, then the distributor will make no profit on the sales of rival SACTs because the price it charges will be the same as its cost of acquiring the rival SACTs from other distributors. Such a distributor would have no incentive to sell a rival product on which it earns zero profits rather than Armstrong products on which they would earn a markup of 12-29%.

the following shall constitute breaches of this Agreement: . . . Distributor having a direct buying relationship with any other manufacturer of competing ceiling products in violation of paragraph 4 of this agreement.”).

²³⁶ Moynihan Deposition at 42 (testifying that distributors buy products from other distributors in “very small amounts”).

²³⁷ McKinney (AWI Director of Pricing for Ceiling Tiles) Deposition at 72 (“O: [REDACTED]”; [REDACTED] v. Lay (AWI) August 14, 2018 Deposition at 174-175 ([REDACTED]); AWI01708325 (page from Armstrong expert report in the Armstrong v Cemex deposition, indicating that the distributor CEMEX was selling Armstrong tiles for 12-16% above the price that they purchased the tiles); FBM 2017 10-K at 45 (FBM specialty building products distributors earned gross margins of an average 29% in 2016 and 2017).

156. For example, suppose that Rockfon sells a particular SACT for \$100, and that distributors charge a markup of 20%. In this situation, unforced distributors who can purchase the Rockfon SACT directly will pay \$100 to Rockfon and charge contractors \$120, earning a \$20 profit per sale of the Rockfon SACT before accounting for distribution costs. In contrast, forced distributors who cannot purchase directly from Rockfon would have to pay \$120 to an unforced distributor for this Rockfon SACT. Consequently, if the forced distributor attempting to make a normal profit on each sale of the Rockfon SACT it would have to charge contractors \$140, and little-to-no of the contractors would buy the Rockfon SACT from the forced distributor charging \$140 because they could alternatively buy the same Rockfon SACT from an unforced distributor charging \$120. Conversely, if the forced distributor attempted to make significant sales of the Rockfon SACT by charging contractors the same price as the unforced distributors (\$120), the forced distributor would not make any profit on any of the sales because its selling price (\$120) would be the same as its cost of purchasing the rival SACT from another distributor (\$120). Even if the forced distributor tried to split the difference by charging only a \$15 markup (thus buying rival SACTs for \$120 and selling them for \$135), the forced distributor would still hardly make any sales (due to charging higher prices than the unforced distributors) and would make less profit on those sales than the distributor would make on its sales of Armstrong products that it can purchase directly. Thus, prohibiting a distributor from buying rival SACTs directly from rival manufacturers functionally makes it unprofitable for the forced distributor to sell rival SACTs at all. This is consistent with deposition testimony that distributors only purchase “very small amounts” of products from other distributors because doing so inefficiently increases their costs and decreases their profits.²³⁸

157. Further, every Armstrong agreement that prohibited the distributor from directly purchasing SACTS from rival manufacturers also included language stating that the distributor must “use its best efforts to promote, sell, and service all

²³⁸ Moynihan Deposition at 42-43 (“A customer, you know, even some of these customers might two-step product. If it’s spec’d a certain product, they might – if they get a spec for – and it says USG Donn grid, they would probably – they would probably not buy it direct, but they would buy it from another distributor. So they’d potentially be selling different products. But very small amounts. They’re going to try to sell their product first because they’re going to make more money on it. Q: And why do distributors make more money selling their product, the product of the manufacturer they mainly distribute? A: They’re going to have rebates. They’re going to buy it at a better price. If you buy through another distributor, you’re going to have to buy at their price plus a markup.”)

[Armstrong] Ceiling Products” and that the distributor “is not using its best efforts if it seeks to substitute or supply a competitive ceiling tile or grid product for an Armstrong product.”²³⁹ This sort of contract term restricting distributors from promoting rival products blocks rival access from the most efficient means of promotion, and is itself a form of exclusive dealing because it requires the distributor to exclusively provide promotional services to Armstrong.²⁴⁰ Moreover this particular contract term banning any effort to “substitute or supply” a rival product is extremely general, going far beyond just a ban on advertising rival products to include even telling a potential buyer that the rival product better meets their needs for a specific project.

E. Armstrong Minimum Purchase Requirements

158. Only █% of Armstrong sales are made to distributors who are neither prohibited from carrying rival products (described above in Section C) nor prohibited from buying rival products directly (described above in Section D). All of these distributors’ agreements allow Armstrong to terminate the agreement if the distributor fails to meet a minimum annual purchase requirement set by Armstrong.²⁴¹ Many distributors with prohibitions against carrying rival products or direct buying from rivals also have minimum purchase requirements, but my analysis of the minimum purchase requirements focuses on the distributors who do not otherwise have foreclosing terms in their agreements, both because they are the ones who incrementally affect the foreclosure share and because identifying the minimum purchase requirements is extremely time-consuming and so cannot be practically done for every Armstrong distributor.²⁴²

²³⁹ “ROXARM75 percent direct purchase seek sub overlap.txt” See, e.g., AWI00069524 (agreement between Armstrong and Ceiling Systems Distribution. “4. Distributor will use its best efforts to promote, sell and service all Ceiling Products within its Territory . . . Distributor is not using its best efforts if it seeks to substitute or supply a competitive ceiling tile or grid product for an Armstrong product.”).

²⁴⁰ John E. Lopatka, *Assessing Microsoft from a Distance*, 75 ANTITRUST L.J. 811, 812, 831 (2009) (“Exclusive promotion—an element of Microsoft’s conduct—was characterized as a form of exclusive dealing to which the models applied. . . . Exclusive promotion has not been studied as extensively as exclusive dealing, but the idea that exclusive promotion can be tantamount to exclusive dealing in some market settings is not difficult to understand.”).

²⁴¹ “ROXARM75 min purchase of remaining.csv”.

²⁴² Armstrong communicates the minimum purchase requirements to distributors in each year in individualized, non-standardized letters. See, e.g., AWI01585408 at AWI01585409 (letter communicating minimum purchase requirements for Kamco’s Brooklyn location for 2015). Thus, determining each distributor’s minimum purchase requirements requires manually searching for its minimum purchase requirement letter in each year.

159. One example of a minimum purchase requirement is in the agreement between Armstrong and Marjam Supply, which states that “Armstrong will provide Distributor, in writing, its minimum annual performance requirements for each . . . year.”²⁴³ Further, these agreements explicitly state that “in the event Distributor fails to meet its minimum purchase requirements, Armstrong may . . . terminate this Agreement ‘for cause.’”²⁴⁴ Armstrong also repeatedly reminded distributors of their minimum purchase requirements with annual letters that would state “as you know, your branch is required, as a condition of your distribution Agreement with Armstrong, to meet minimum annual performance requirements.”²⁴⁵ In these agreements, Armstrong referred to its minimum SACT purchase requirement as its “Core Ceilings” “contract target.”²⁴⁶

160. The evidence indicates that Armstrong’s minimum purchase requirements were tailored to each distributor branch so that they would functionally prevent the branch from switching some of their Armstrong SACT purchases to rival SACT manufacturers. Table 9 below shows the minimum purchase requirements for the Armstrong distributor branches in 2014 that did not have other types of foreclosing terms in their distributor agreements.²⁴⁷ As Table 9 shows, the minimum purchase requirements were tailored for each distributor to constitute a high percentage of each distributor’s prior year purchases of SACTs from Armstrong, and thus varied greatly from [REDACTED]. Indeed, from 2012-2017 Armstrong on average set its SACT purchase minimum equal to

²⁴³ AWI00069783 at AWI00069784.

²⁴⁴ See, e.g. AWI00069774 at AWI00069775 (Armstrong distribution agreement with Kamco Supply of Brooklyn, stating “7. In the event Distributor fails to meet its minimum purchase requirements, Armstrong (1) may terminate this Agreement ‘for cause’”).

²⁴⁵ See, e.g. AWI01569790 (March 4, 2013 letter from Armstrong to Kamco Supply of New England, Cranston Rhode Island branch. “As you know, your branch is required, as a condition of your distribution agreement with Armstrong, to meet minimum annual performance requirements”).

²⁴⁶ See, e.g. AWI01585414 at AWI01585415 (letter from Armstrong to Marjam Supply of Brooklyn, communicating purchase minimums for 2015. The purchase minimum for “Core Ceilings” was [REDACTED]).

²⁴⁷ My analysis of Armstrong’s minimum purchase requirements focuses on the customers who were not foreclosed by other types of terms in their Armstrong agreements because these are the customers for which the minimum purchase requirement has the greatest foreclosing effect. In contrast, customers who also have terms in their agreements explicitly prohibiting the purchase of rival SACTs are already completely foreclosed by those “no rival purchase” terms, and therefore any minimum purchase requirement in their agreement does not increase the amount by which that customer is foreclosed.

██████████.²⁴⁸ Because past distributor purchases tend to predict future purchase needs, with some adjustment for changing market conditions, these minimum requirements predictably constituted a high percentage of the actual contract year Armstrong purchases, as Table 9 also confirms. In fact, from 2011 to 2017, Armstrong's minimum SACT purchase requirement was on average equal to ██████% of these listed customers' actual contract year Armstrong SACT purchases.²⁴⁹ This evidence indicates that the annual minimum purchase requirements were tailored to functionally prevent SACT distributors from switching any significant portion of their Armstrong SACT purchases to rival SACT manufacturers. The fact that the minimum requirements varied so greatly also indicates that these requirements could not reflect volume-based efficiencies, which would instead be furthered by having a similar minimum for each distributor.

²⁴⁸ "ROXARM72 purchase min as pct of prev year AWI purchase.csv". Armstrong produced sales data starting in 2011, so the first year for which Armstrong produced prior year sales data is 2012.

²⁴⁹ "ROXARM72 purchase min and actuals aggregated otherwise unforclosed.csv".

Table 9: Minimum Armstrong SACT Purchase Requirements for 2014²⁵⁰			
Customer Name & Branch	Minimum Requirement	Minimum as % of <i>Prior Year</i> Purchases	Minimum as % of <i>Contract Year</i> Purchases
Marjam Brooklyn, NY			
Kamco Woburn, MA			
Kamco Brooklyn, NY			
Marjam Stoneham, MA			
Kamco Wallingford, CT			
Marjam West Hartford, CT			
Kamco Albany, NY			
Kamco Cranston, RI			
Marjam Albany, NY			

161. Indeed, a Rockfon sales representative testified that Kamco of Connecticut (one of the distributors that was subject to an Armstrong minimum purchase requirement but did not have contract language explicitly prohibiting the purchase of rival SACTs) tried to place an order for Rockfon SACTs but “was told by his higher-ups that he was not allowed to place the order. That they said they didn’t want to jeopardize their relationship with Armstrong.”²⁵¹ This confirms that

²⁵⁰ “ROXARM72 purchase mins and actuals.xlsx”

²⁵¹ Hart (Roxul) Deposition at 227-229 (“Q: . . . Has any distributor ever told you that it wanted to purchase ceiling tile from Rockfon but could not because of an agreement that distributor had with Armstrong? A: Yes. Q: Which distributor? A: Directly to me that I heard was Kamco in Connecticut. Q: Who did you speak with at Kamco? A: It was Jason Hence. Q: When did this conversation take place? A: . . . I don’t know if it was in 2013 or 2014. . . Q: What did Mr. Hence tell you? A: He said that he had been given permission to place an order – I don’t remember the specifics – but he was given – given permission to place an order, that he wanted my help helping him get an order together, what made sense. . . . I called the next day. . . he said he was told by his higher-ups that he was not allowed to place the order. That they said they didn’t want to jeopardize their relationship with Armstrong.”)

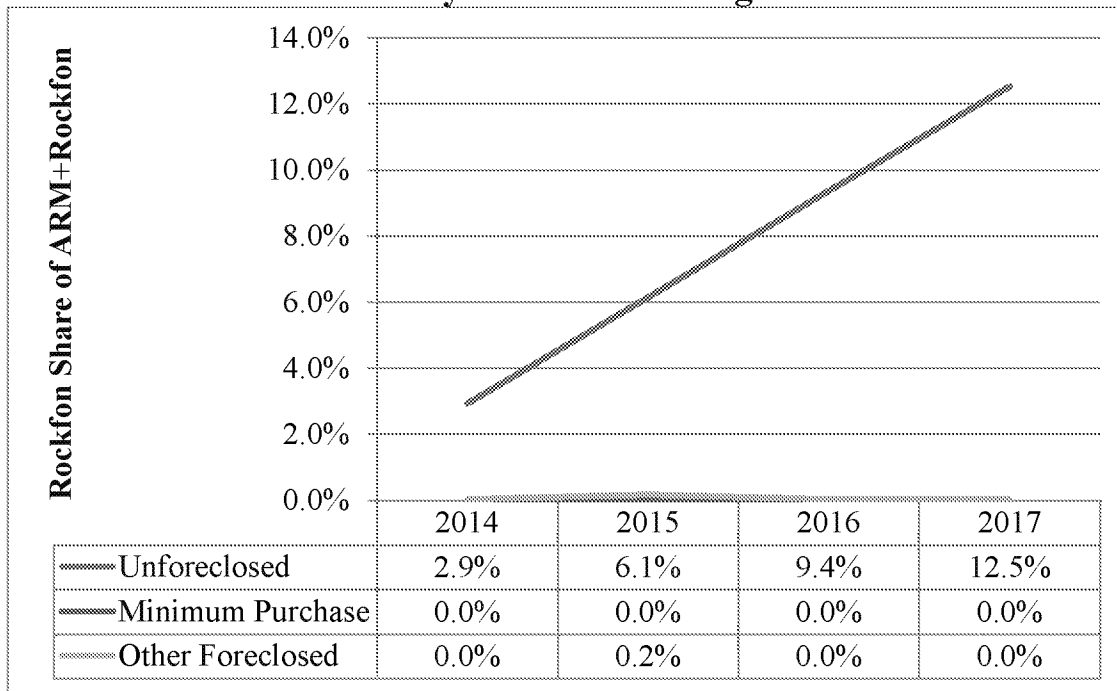
the Armstrong minimum purchase requirements had a foreclosing effect on Rockfon.

162. Armstrong and Rockfon sales data confirms that the foreclosing effect of Armstrong's tailored minimum purchase requirements was comparable to the foreclosing effect of Armstrong's other types of foreclosing terms. Figure 16 below compares Rockfon's share of Rockfon-plus-Armstrong SACT sales²⁵² among three groups: (1) unforeclosed customers ("unforeclosed"); (2) customers foreclosed by Armstrong minimum purchase terms ("minimum purchase"); and (3) customers foreclosed by other types of Armstrong contract terms explicitly prohibiting the purchase of Rockfon or any rival manufacturer SACTs ("other foreclosed").²⁵³ This figure shows that Rockfon did not grow its share at all from 2013-2017 in either the "other foreclosed" group or the "minimum purchase" group, confirming that Armstrong's tailored minimum purchase requirements are similarly foreclosing as Armstrong's other types of foreclosing contract terms. In contrast, Rockfon's share grew significantly in the unforeclosed group from 2.9% in 2014 to 12.5% in 2017.

²⁵² I cannot include CertainTeed and USG in this calculation because they did not produce the customer-level data necessary to identify which of their customers were covered by Armstrong minimum purchase requirements.

²⁵³ Customers who have both minimum purchase requirements and other types of Armstrong foreclosing agreements are in the "foreclosed other" group.

Figure 16: Rockfon Share of Armstrong-Plus-Rockfon SACT Sales, Unforeclosed vs. Foreclosed By Only Minimum Purchase Requirement vs. Foreclosed By Other Armstrong Terms²⁵⁴



F. USG Exclusive Dealing Agreements with Distributors

163. **a. USG Restrictions on L&W.** USG’s largest purchaser of SACTs by far is L&W Supply, a company that owns many distributors throughout the United States.²⁵⁵ L&W was a subsidiary of USG until December 31, 2016, and USG prohibited L&W locations from carrying rival manufacturer SACTs while it owned L&W.²⁵⁶ On December 31, 2016, USG sold L&W to the company ABC,

²⁵⁴ “ROXARM74 rockfon rev share of forc_min, forc_other, unforc.csv”.

²⁵⁵ “ROXARM23 USG top tile customers.xlsx”. L&W accounted for 41% of USG’s SACT revenue from 2013 to 2017.

²⁵⁶ AWI00019893, “Distributor” tab, CelleE70 (2011 survey of Armstrong distributors reporting on competing distributors in the area. “There is a L&W . . . They are owned by USG so they sell only USG stuff”); *id.*, cell F70 (“L&W stores. They are all USG”); AWI00145825 at AWI00145835 Keybank Capital Markets USG Report (“USG grew its business by acquiring large distributors in select markets to increase its revenue and building product distribution market share by selling its own wallboard and ceiling products instead of its competitors’ products.”).

and entered into a distribution agreement with L&W.²⁵⁷

164. **b. USG Restrictions on FBM.** FBM has produced an agreement with USG under which

165. **c. USG Restrictions on GMS.** On January 25, 2012, USG entered into an agreement with GMS

166. **d. Uncertainty About USG Restrictions on Other Distributors.** Because USG has not produced any agreements for its other distributors, I do not know with certainty whether USG foreclosed its other distributors. However, available evidence indicates that USG has a general practice of prohibiting its distributors from buying SACTs from rival manufacturers. For example, a market research report from 2016 quoted an anonymous industry source as saying “AWI [Armstrong] and USG typically will threaten to totally cut off supply or remove

²⁵⁷ LW_Supply0000072 (December 31, 2016 agreement between USG and L&W supply following USG’s sales of L&W to ABC).

²⁵⁸ USG-0000326 at USG-0000327 (agreement between USG and L&W in connection with the sale of L&W to ABC)

id. at USG-0000327 (USG agreement with L&W)

id. at USG-0000363

²⁵⁹ USG-0000326 USG-0000342

²⁶⁰ FBM 000209.

²⁶¹ USG-0000322.

discounts if a distributor is considering adding a competing product.”²⁶² Similarly, another market research report stated that it expected both Armstrong and USG to “enforce their [distributor] exclusivity even more strictly” following the entry of Rockfon.²⁶³ Yet another market research report noted that “AWI [Armstrong] and USG established exclusive dealer networks decades ago.”²⁶⁴ A surveyed distributor likewise stated that “the manufacturers don’t want us to have another tile to rep another tile. USG is USG and that is all they want you to carry.”²⁶⁵

G. Conflicting Evidence Regarding CertainTeed’s Foreclosure of Distributors

167. Although there is evidence that CertainTeed told some distributors that they should not sell Rockfon tiles, other evidence indicates that CertainTeed’s attempts to foreclose Rockfon from access to distributors were either half-hearted or ineffectual.

168. Available evidence indicates that CertainTeed had a standard practice of telling its distributors that CertainTeed would stop supplying them if the distributors began carrying Rockfon ceiling tiles.²⁶⁶ For example, in November 2013, a distributor reported to Rockfon that CertainTeed told the distributor that “they would no longer sell us their ceiling products at any of [the distributor’s] 13 locations if [the distributor] continued to carry and promote the Rockfon product line,” and that the distributor “was led to believe that this was a company wide position that came down from St. Gobain [CertainTeed’s parent company] in Paris.”²⁶⁷ This is consistent with an internal Armstrong email reporting that CertainTeed was “making moves to sever ties with distributors who are handling Rockfon,” and gave the example that “CertainTeed pulled the line from Above All

²⁶² AWI01095935 at AWI01095941.

²⁶³ GYMSUM00003812 at 814 SunTrust Bank Research Report (“Expected AWI/USG to Defend Distributor Share. This is already a very sensitive topic in the industry and we suspect that both players will enforce their exclusivity even more strictly.”).

²⁶⁴ SKP000423.

²⁶⁵ AWI00019894.

²⁶⁶ CertainTeed’s standard written agreements with distributors entitle [REDACTED]

See, e.g.,

CERTAINTTEED000015 [REDACTED]

Thus, [REDACTED]

²⁶⁷ ROXUL_1916489 at ROXUL_1916490.

Interiors in Miami who has been out promoting Rockfon.”²⁶⁸ Similarly, an internal Rockfon email reported that CertainTeed told Action Gypsum Supply in Phoenix, Arizona, that CertainTeed “will not support them if they sell Rockfon tile in Phoenix.”²⁶⁹ Likewise, another internal Rockfon email included an excerpt from an email that a CertainTeed territory manager sent to a distributor, stating “Under no circumstances do I want to make life easier for ANY Contractor/Sub, etc. to buy Rockfon. They could not go to USG or AWI [Armstrong] distributor and request them to get Rockfon for them, and the same goes for a CertainTeed distributor. . . I do not want Rockfon to get a foothold in the Pittsburgh or any market in territory, and then have to deal with another competitor.”²⁷⁰

169. However, Rockfon’s President testified in Rockfon’s 30(b)(6) deposition that CertainTeed “did not put significant pressure on shared distributors not to sell Rockfon tile.”²⁷¹ He also testified that, although CertainTeed did request that some of its distributors not sell Rockfon SACTs, those requests were “not followed” in the sense that the “distributor ignored it” and bought Rockfon anyways, and that CertainTeed often did not punish the distributor for doing so.²⁷²

170. Thus, the evidence conflicts on whether CertainTeed was effectively foreclosing distributors. Further, even if the evidence indicated clearly which distributors were foreclosed, one cannot determine the portion of CertainTeed’s sales to foreclosed customers because CertainTeed did not produce data broken down by customer. Here, I conservatively ignore any foreclosure caused by CertainTeed’s distributor agreements.

²⁶⁸ AWI00013879.

²⁶⁹ ROXUL_1801896 (April 8, 2017 internal Rockfon email reporting that “[CertainTeed] came back this week with all court press telling Action [Gypsum Supply in Phoenix, Arizona] that they will not support them if they sell Rockfon tile in Phoenix. . . . Eric Brown (VP sales [CertainTeed]) is writing threatening letters and calling”).

²⁷⁰ ROXUL_1805347 (March 18, 2017 internal Rockfon email).

²⁷¹ Medio (Rockfon 30(b)(6)) Deposition at 205 (“Q: So your understanding is that Certainteed did not put significant pressure on shared distributors not to sell Rockfon tile? A: Correct. I think significant pressure would be dramatically overstating what we heard their activities were.”).

²⁷² Medio (Rockfon 30(b)(6)) Deposition at 206 (“Q: And to go back to Certainteed, is it your understanding that Certainteed asked distributors who were carrying Certainteed tile at branches that were carrying CMC grid not to take on Rockfon tile? A: Yes. We heard some examples of that, but it wasn’t followed. Q: Wasn’t followed in the sense of what? A: The distributor ignored it. And they told us about it and said I’m still going to buy Rockfon. And in some cases, Certainteed tried to change the line and said, okay, we’re going to go with a different distributor. In other cases, they didn’t do anything and just continued having a relationship.”).

III. FORECLOSURE OF RIVAL SACT MANUFACTURERS

171. Here, I present multiple types of evidence showing that Armstrong and USG's agreements with distributors have significantly foreclosed rival SACT manufacturers such as Rockfon. Specifically, I show below that: (A) Armstrong (both on its own and in combination with USG) has foreclosed large shares of North America, the U.S., and almost every regional market within the U.S.; (B) these large foreclosure shares are exacerbated by other facts that increasing their foreclosing effects, such as the long terms of Armstrong's agreements and the inability of distributors to terminate them without cause; (C) there are multiple concrete examples that unequivocally show distributors initially evincing a preference for Rockfon SACTs but being forced to stop buying Rockfon SACTs after they become foreclosed; and (D) statistical analysis showing that Rockfon has grown significantly among unforeclosed customers than among foreclosed customers.

A. Foreclosure Shares

172. When analyzing agreements that restrain the purchase of rival products, such as exclusive dealing, economists routinely calculate the percentage of the market subject to this restraining conduct, which is called the "foreclosure share." The larger the foreclosure share, the more likely the restraints are to cause anticompetitive harm.

173. Here, both Armstrong and USG used agreements that restrain the purchase of rival products, so one must calculate the *cumulative* foreclosure caused by Armstrong and USG's conduct combined to determine whether the total foreclosure was significant enough to cause anticompetitive harm.²⁷³ This is because the anticompetitive effects of marketwide foreclosure depend on the size of that marketwide foreclosure rather than the origin of that foreclosure. For example, 100% marketwide foreclosure causes the significant anticompetitive effects of forcing all other rivals to exit and deterring new rival entry. Two duopolists that cumulatively foreclose 100% of the market cause these anticompetitive effects of forcing rival exit and deterring rival entry just as much as a single monopolist that forecloses 100% all on its own. From an economic

²⁷³ See ELHAUGE, U.S. ANTITRUST LAW & ECONOMICS 392-394 (3d ed. 2018); 9 PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW ¶ 1729, at 328, 337 (2d ed. 2004); Einer R. Elhauge, *Tying, Bundled Discounts, and the Death of the Single Monopoly Profit Theory*, 123 HARV. L. REV. 397, 477 (2009).

perspective, one should cumulate the foreclosing effects of multiple firms' restraints regardless of whether those firms conspired with each other to engage in the foreclosing restraints, because the anticompetitive effects do not require any agreement between the firms engaging in the foreclosing restraints. Ultimately, these economic points mean that the relevant measure of foreclosure for inferring anticompetitive effects is the cumulative foreclosure caused by Armstrong and USG.

1. Foreclosed vs. Unforeclosed Classification

174. Below, I describe how I specifically classified each sale as foreclosed or unforeclosed when calculating foreclosure shares. For clarity, when I discuss "customers" below I am referring to the direct-purchaser customers of the SACT manufacturers.

175. **a. Armstrong Sales to Distributors.** I classify all Armstrong SACT sales to a distributor as foreclosed if the distributor's agreement with Armstrong had: (1) a prohibition against carrying or selling any competing manufacturers' SACTs, as described above in Part II.C; (2) a prohibition against directly purchasing rival manufacturer SACTs, as described above in Part II.D; or (3) a prohibition against buying Rockfon SACTs in particular. From 2013-2017, on average 85% of Armstrong's SACT sales to distributors were foreclosed by one of these three prohibitions.²⁷⁴

176. If an Armstrong distributor's agreement did not have term (1), (2), or (3), but did have an annual minimum purchase requirement, then I consider the portion of that distributor's Armstrong SACT purchases that are necessary to meet the annual minimum requirement as foreclosed (see above Part II.A.4). For example, in 2014 Marjam of Brooklyn's minimum annual SACT purchase requirement was \$ [REDACTED] and its actual Armstrong SACT purchases were \$ [REDACTED], so I classify \$ [REDACTED] of Marjam of Brooklyn's Armstrong SACT purchases as foreclosed and the rest of their actual purchases (\$ [REDACTED]) as unforeclosed.²⁷⁵ As another example, Kamco of Woburn's minimum purchase requirement in 2014 (\$ [REDACTED]) was slightly higher than its actual Armstrong SACT purchases in 2014 (\$ [REDACTED]), so I classified all of Kamco of Woburn's Armstrong SACT purchases as foreclosed. Including the foreclosure from Armstrong's

²⁷⁴ "ROXARM70 awi foreclose % by cust group (no minpurchase).csv".

²⁷⁵ "ROXARM72 purchase mins and actuals.xlsx".

minimum purchase requirements, on average 97% of Armstrong's SACT sales to distributors were foreclosed from 2013-2017.²⁷⁶

177. **b. Armstrong Sales to All Other Customers.** Although there is some evidence indicating that Armstrong internally discussed trying to foreclose Rockfon from access to direct purchaser contractors,²⁷⁷ I have not seen direct evidence that Armstrong did enter into agreements with direct purchaser contractors that restricted them from buying rival SACTs. I therefore assume conservatively that all Armstrong sales to direct purchase contractors and any other customers other than distributors are unforeclosed.

178. **c. USG Sales.**

I therefore classify all USG sales to FBM and GMS as foreclosed by Armstrong agreements during the time periods after those agreements became effective.

179. USG also prohibited L&W from distributing rival SACTs while it owned L&W, so I classify all USG sales to L&W as foreclosed by USG agreements. Although evidence suggests that USG generally forecloses most of its distributors,²⁷⁹ USG has not produced any of its other distributor agreements so I do not know with certainty whether USG has foreclosed its other distributors. For the purposes of calculating foreclosure shares, I conservatively assume that all of USG's sales to customers besides L&W, FBM, and GMS are unforeclosed to show that the foreclosure shares are significant regardless of one's conclusion regarding the foreclosure of other USG customers. Given this conservative assumption, USG's sales data indicates that [REDACTED] % of its

²⁷⁶ "ROXARM70 awi foreclose % by cust group.csv".

²⁷⁷ See, e.g., AWI00066845 (October 2013 internal Armstrong email chain in which Paul Corr, Armstrong's Regional Vice President for the Eastern United States, states "we have the commitment from the largest distributors to avoid [Rockfon] even in markets where [the distributor has] no [SACT] line. We are working on the contractor base now.").

²⁷⁸ "ROXARM23 USG p of sales foreclosed by awi agreements.csv".

²⁷⁹ See *supra* Part II.F.

U.S. SACT sales revenue was foreclosed by Armstrong or USG from 2014-2017, depending on the year.²⁸⁰

180. **d. CertainTeed Sales.** As I described above in Part II.G, given conflicting evidence and data limitations, I conservatively assume that CertainTeed was not able to successfully foreclose rivals. However, Armstrong did foreclose Rockfon from all of CertainTeed's sales to GMS and FBM under its agreements that prohibit even non-Armstrong FBM and GMS locations from carrying Rockfon. Although one should therefore classify all CertainTeed sales to FBM and GMS as foreclosed, CertainTeed did not break down its sales data by customer so I cannot tell what portion of its sales were made to FBM and GMS. For my foreclosure analysis, I conservatively assume that all CertainTeed sales were unforeclosed.

181. **e. Rockfon.** I consider all Rockfon sales as unforeclosed.

2. North American Foreclosure Shares

182. I have no evidence regarding USG's contracts with Canadian distributors, so I conservatively assume that all of USG's sales in Canada are unforeclosed. I consider all CertainTeed and Rockfon Canadian sales to be unforeclosed as well, consistent with my foreclosure classifications above. Table 10 below shows the shares of the North American SACT market foreclosed in each year. I present these shares both in terms of revenue and feet squared, and also separately report the shares of sales (1) foreclosed solely by Armstrong agreements; and (2) foreclosed in aggregate by Armstrong and USG agreements.

²⁸⁰ "ROXARM23 USG p of sales foreclosed by awi or usg agreements.csv".

Table 10: Share of North American SACT Sales Foreclosed ²⁸¹				
Year	Share Foreclosed by Only Armstrong Agreements		Share Foreclosed by Armstrong and USG Agreements Combined	
	\$	ft ²	\$	ft ²
2013	46%	38%		
2014	49%	40%		
2015	50%	40%		
2016	51%	41%		
2017	51%	40%		

183. Although the evidence indicates that Armstrong’s annual minimum purchasing requirements do foreclose rivals from access to distributors, I also present foreclosure shares below in Table 11 under the conservative assumption that Armstrong’s minimum purchase requirements are *not* foreclosing in order to illustrate that foreclosure shares are still significant under such a conservative assumption.

²⁸¹ “ROXARM71 North American foreclosure shares.csv”.

Table 11: Share of North American SACT Sales Foreclosed Assuming Armstrong's Minimum Purchase Terms Are Not Foreclosing²⁸²				
Year	Share Foreclosed by Only Armstrong Agreements		Share Foreclosed by Armstrong and USG Agreements Combined	
	\$	ft²	\$	ft²
2013	40%	35%	51%	46%
2014	43%	37%	53%	47%
2015	44%	37%	54%	48%
2016	45%	37%	55%	48%
2017	45%	37%	56%	48%

3. U.S. Foreclosure Shares

184. Table 12 shows the shares of U.S. SACT sales foreclosed in each year from 2013 to 2017. I present these shares both in terms of revenue and feet squared, and also separately report the shares of sales (1) foreclosed solely by Armstrong agreements; and (2) foreclosed in aggregate by Armstrong and USG agreements. Foreclosure shares in the United States are similar to foreclosure shares in North America because there are significantly fewer Canadian sales relative to U.S. sales, and Armstrong entered into the same sorts of foreclosing agreements with Canadian distributors as it did with domestic distributors.

²⁸² "ROXARM71 North American Foreclosure Shares noMinPurchase.csv".

Table 12: Share of U.S. SACT Sales Foreclosed ²⁸³				
Year	Share Foreclosed by Only Armstrong Agreements		Share Foreclosed by Armstrong and USG Agreements Combined	
	\$	ft ²	\$	ft ²
2013	46%	38%		
2014	49%	40%		
2015	50%	40%		
2016	51%	41%		
2017	51%	40%		

185. Although the evidence indicates that Armstrong's annual minimum purchasing requirements do foreclose rivals from access to distributors, I also present foreclosure shares below in Table 13 under the conservative assumption that Armstrong's minimum purchase requirements are *not* foreclosing in order to illustrate that foreclosure shares are still significant under such a conservative assumption.

²⁸³ "ROXARM71 US foreclosure shares.csv".

Table 13: Share of U.S. SACT Sales Foreclosed Assuming Armstrong's Minimum Purchase Terms are Not Foreclosing²⁸⁴				
Year	Share Foreclosed by Only Armstrong Agreements		Share Foreclosed by Armstrong and USG Agreements Combined	
	\$	ft²	\$	ft²
2013	40%	34%		
2014	42%	36%		
2015	43%	37%		
2016	44%	37%		
2017	45%	37%		

4. Regional Foreclosure Shares

186. Table 14 below shows the foreclosure share created by Armstrong and USG agreements in each of the 61 regional price discrimination markets within the United States from 2013-2017. For reasons discussed earlier, the foreclosure shares include foreclosure by minimum purchase requirements, other than in versions where I expressly note the alternative results if one conservatively excludes them.

²⁸⁴ “ROXARM71 US foreclosure shares assume min purchase unforcedclosed.csv”.

Table 14: Regional Foreclosure Shares Caused by Armstrong and USG Agreements Combined²⁸⁵					
Price Metro	2013	2014	2015	2016	2017
NEW YORK					
LOS ANGELES					
PHILADELPHIA					
BALT-WASH					
CHICAGO					
BOSTON					
OHIO					
SAN FRANCISCO					
HOUSTON					
DALLAS					
NORTH CAROLINA					
ATLANTA					
MINNEAPOLIS					
HARTFORD					
WISCONSIN					
NEW JERSEY					
DENVER					
NORTH CENTRAL FLORIDA					
MIAMI					
UPSTATE NEW YORK					
PHOENIX					
WEST PENNSYLVANIA					
INDIANAPOLIS					
BIRMINGHAM-JACKSON					
SEATTLE					
SOUTH CAROLINA					
EAST MICHIGAN					
MIDWEST					
RICHMOND					
PENSACOLA					
OKLAHOMA CITY					
WEST MICHIGAN					
TAMPA					
ST LOUIS					

²⁸⁵ “ROXARM85 regional foreclosure shares awi+usg.”

DES MOINES	
MEMPHIS	
NEW ORLEANS	
NEBRASKA	
AUSTIN	
PORTLAND	
UTAH	
KENTUCKY	
NASHVILLE	
RIO GRANDE	
SAN ANTONIO	
RENO	
E TEXAS-N LOUISIANA	
EAST TENNESSEE	
MOUNTAIN	
LAS VEGAS	
ILLINOIS	
SPOKANE	
WICHITA	
NW ARKANSAS	
CENTRAL TEXAS	
ALASKA	
AMARILLO	
WESTERN KENTUCKY	
WEST TEXAS	
DELAWARE	
N TEXAS	

187. Table 15 below summarizes the foreclosure shares created by Armstrong and USG agreements in the 61 relevant regional markets within the United States. It shows that the foreclosure share is at least █% in almost every regional market (at least █ in every year). Foreclosure shares are also greater than █% in most regional markets (█ of them, depending on the year).

Table 15: Number of Regions for Which Armstrong-USG Foreclosure Share Exceeded Certain %²⁸⁶						
Year	≥ 20%	≥ 30%	≥ 40%	≥ 50%	≥ 70%	≥ 90%
2013						
2014						
2015						
2016						
2017						

188. Table 16 below summarizes the foreclosure shares created by only Armstrong agreements in the 61 relevant regional markets within the United States. The foreclosure shares are at least 20% in almost every regional market (at least ■ in every year) and are greater than 40% in most regional markets (■, depending on the year).

Table 16: Number of Regions for Which Armstrong-Only Foreclosure Share Exceeded Certain %²⁸⁷						
Year	≥ 20%	≥ 30%	≥ 40%	≥ 50%	≥ 70%	≥ 90%
2013						
2014						
2015						
2016						
2017						

189. Table 17 below summarizes the market shares foreclosed by only Armstrong agreements if one conservatively assumes that the minimum purchase requirements are not foreclosing. Even with this conservative assumption, the foreclosure shares are at least 20% in at least ■ markets in every year and are greater than 40% in most regional markets (■, depending on the year).

²⁸⁶ “ROXARM85 regional foreclosure gtX by awi or usg.csv”.

²⁸⁷ “ROXARM85 regional foreclosure gtX by just awi.csv”.

Table 17: Number of Regions for Which Armstrong-Only Foreclosure Share Exceeded Certain % If Minimum Purchase Agreements Are Conservatively Deemed Non-Foreclosing²⁸⁸						
Year	≥ 20%	≥ 30%	≥ 40%	≥ 50%	≥ 70%	≥ 90%
2013						
2014						
2015						
2016						
2017						

190. Table 18 below summarizes the market shares foreclosed by Armstrong and USG agreements if one conservatively assumes that the minimum purchase requirements are not foreclosing. Even with this conservative assumption, the foreclosure shares are at least ■% in at least ■ markets in every year and are greater than ■% in most regional markets (■■■■), depending on the year).

Table 18: Number of Regions for Which Armstrong-USG Foreclosure Share Exceeded Certain % If Minimum Purchase Agreements Are Conservatively Deemed Non-Foreclosing²⁸⁹						
Year	≥ 20%	≥ 30%	≥ 40%	≥ 50%	≥ 70%	≥ 90%
2013						
2014						
2015						
2016						
2017						

B. Factors Exacerbating Foreclosure Shares

191. Here, there are several factors that make the foreclosure of the SACT market especially likely to be anticompetitive: (a) Armstrong's agreements restraining distributors have long terms; (b) Armstrong's restraining agreements are neither legally nor practically terminable by the distributor; (c) restrained distributors are highly compliant with Armstrong's restraints; and (d) significant

²⁸⁸ "ROXARM85 regional foreclosure gtX by just awi (nominpurchase).csv".

²⁸⁹ "ROXARM85 regional foreclosure gtX by awiORusg (nominpurchase).csv".

incontestable demand for the replacement of Armstrong tiles prevents smaller competitors from winning 100% exclusive distributors away from Armstrong.

192. **a. Armstrong's Foreclosing Agreements Have Long Terms.** From 2014 onward, the average active length of Armstrong's foreclosing agreements was just over 3 years, with the minimum term being 1 year and the maximum term being 5 years.²⁹⁰

193. **b. Armstrong's Foreclosing Agreements are Neither Legally Nor Practically Terminable.** Armstrong's standard distributor agreements do not allow distributors to terminate their agreements without cause before the expiration of the agreements. Indeed, Armstrong's sales data show that none of the SACT sales it has made to distributors since October 2013 (when Roxul acquired CMC) were under agreements that gave the distributor the ability to terminate the agreement without cause.²⁹¹ Moreover, to prevent Armstrong's agreements from auto-renewing when their initial terms expire, the distributor must provide written notice of the intent not to renew the agreement at least 60 days before the agreement ends (some agreements require even more notice to prevent auto-renewal, such as 90 or 180 days' notice).²⁹²

194. Further, even in the rare situations where distributors have the technical legal ability to end (or choose not to renew) their agreements with Armstrong, distributors do not have the *practical* ability to terminate their agreements because that would make them lose the ability to buy Armstrong

²⁹⁰ "ROXARM75 AWI current termlength stats.csv". The average is weighted by net sales. This statistic accounts for Armstrong's auto-renewal terms by defining a customer's current term length as its renewal term length if the original end date of its agreement has passed.

²⁹¹ "ROXARM75 US AWI SACT distributor sales terminability.csv".

²⁹² The minimum notice required to prevent auto-renewal is 60 days. *See, e.g.*, AWI00069940 at AWI00069941 (2016 agreement between Armstrong and [REDACTED] [REDACTED] "Following the expiration of the initial term, this Agreement will automatically renew for successive one (1) year renewal terms, unless the parties mutually agree to extend such renewal period for a longer period of time, or unless either party gives written notice of its intent to terminate the Agreement on no less than sixty (60) days prior to the expiration date, in which case the term of this Agreement shall not renew and shall automatically terminate with no further action required of the parties."); AWI01708171 (2015 agreement between Armstrong and [REDACTED] [REDACTED] "This agreement will automatically renew for successive three (3) year terms on May 1, 2018 and on each anniversary of such date thereafter . . . unless either party gives written notice of its intent to terminate the Agreement no less than one hundred eighty (180) days prior to such Renewal Date, in which case the term of this Agreement shall not renew and shall terminate at the end of the current three (3) year term").

products. In other words, terminating the restrictive Armstrong agreements would not allow the distributor to evade the penalty for violating Armstrong's restrictions against purchasing from rivals (termination) but rather would self-inflict that penalty. Losing the right to purchase Armstrong SACTs is an especially significant penalty because around half of SACT demand is for the selective replacement of existing tiles,²⁹³ where the contractor must replace damaged or worn-out tiles with the same model of tile that was originally installed, and Armstrong's historically dominant market share means that Armstrong tiles constitute the majority of that replacement tile demand. Thus, it is not practical for distributors to terminate their Armstrong agreements because doing so would make them sacrifice all of the sales of Armstrong tiles for replacement jobs.

195. **c. High Compliance Rate With Armstrong's Exclusivity Terms.** Foreclosed Armstrong distributors essentially never buy Rockfon SACTs. Sales data shows that Rockfon's share of SACT sales (in terms of square feet) among foreclosed Armstrong distributors was never higher than 0.1% in any year.²⁹⁴

196. **d. Distributors Have Testified That Armstrong Agreements Prevented Them from Selling Rival SACTs When The Distributors Wanted To Do So.** In October 2010, the distributor CEMEX, which at the time was subject to an Armstrong distributor agreement that prohibited it from having a "direct buying relationship with any other manufacturer of competing ceiling products," asked Armstrong if it could start selling additional brands of SACTs.²⁹⁵ Frank Pasquerello of Armstrong responded that CEMEX was not allowed to have "another line" of SACTs on hand while its agreement with Armstrong was still effective.²⁹⁶ More recently, Ryan Building materials in Eastern Michigan was buying and distributing significant amounts of Rockfon SACTs until it was purchased by GMS, after which it was forced to stop selling Rockfon pursuant to the preexisting no-Rockfon agreement between GMS and Armstrong.²⁹⁷ David

²⁹³ See *supra* Part II.C.1.

²⁹⁴ "ROXARM94 forc unforc shares awionly.csv".

²⁹⁵ AWI01708534 at AWI01708535-36 (CEMEX asked Armstrong "Bringing on 'new acoustical line' ASAP – any issues?").

²⁹⁶ AWI01708534 at AWI01708536. In this email, Pasquerello reminded CEMEX of the terms of their Armstrong agreement stating that they "will not have a direct buying relationship with any other manufacturer of competing ceiling products," and said that CEMEX could do no more than talk to competing manufacturers during the term of their agreement with Armstrong.

²⁹⁷ McCatty Deposition at 38-39 ("Q: When did GMS purchase Ryan Building Materials? A: October 31st of 2016. Q: And as part of that deal, GMS told you that Ryan yards could no longer carry Rockfon tile; correct? A: Yeah, that's correct." . . . Q: And at the time did this

McCatty, who worked at Ryan Building Materials at the time of the acquisition, testified that Ryan Building materials wasn't "happy about" not being allowed to buy Rockfon anymore because "we'd rather have more manufacturers than less."²⁹⁸

C. Examples of Foreclosure Reducing Rockfon Sales

197. Although systematic analysis of all customers' sales data is the most accurate way to measure how much Armstrong's foreclosure has slowed Rockfon's growth, concrete examples illustrate how Armstrong's agreements prevented distributors from buying or distributing Rockfon SACTs. Below, I provide a non-exhaustive list of distributors who were forced to stop selling Rockfon SACTs when they became subject to Armstrong agreements that prohibited them from buying Rockfon SACTs.

198. **a. Ryan Building Materials in Southfield, Michigan.** Up until November 2016, Ryan Building Materials had been unforced and was steadily increasing its purchases of Rockfon SACTs.²⁹⁹ However, on November 3, 2016, GMS acquired Ryan Building Materials,³⁰⁰ and therefore Ryan Building Materials became subject to the "No Rockfon" agreement between Armstrong and GMS.³⁰¹ Internal Armstrong emails confirm that the GMS's agreement "forbids the direct purchase of Rockfon" and that "when GMS bought Ryan and GSC, those brands severed their relationship with Rockfon."³⁰² David McCatty, who worked at Ryan Building Materials when it was acquired by GMS, similarly testified that Ryan Building Materials was forced to stop selling Rockfon after they were acquired by GMS and that Ryan Building Materials was not "happy about" that because they preferred to "have more manufacturers than less."³⁰³ Figure 17 below shows that

bother you? A: We weren't happy about it. Q: Why? A: We'd rather have more manufacturers than less, so..."). *See also* Part III.C below for a more detailed analysis of the foreclosure of Ryan Building Materials.

²⁹⁸ *Id.*

²⁹⁹ *See infra* Figure 17.

³⁰⁰ <https://www.lbmjournal.com/gms-acquires-ryan-building-materials/> (November 3, 2016 post stating "GMS . . . announced today the acquisition of Ryan Building Materials").

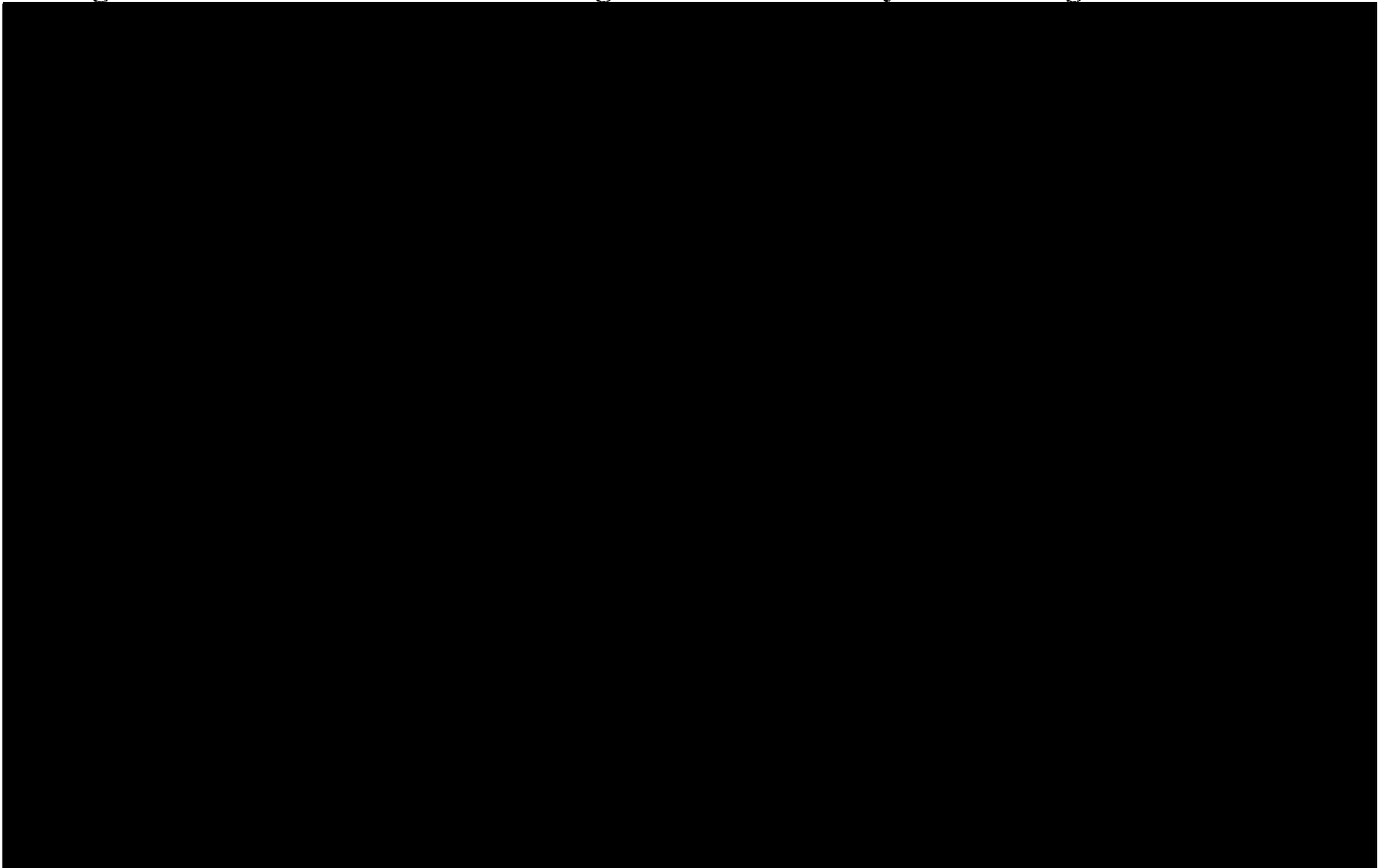
³⁰¹ AWI00619437 at AWI00619437-38 (GMS agreement with Armstrong establishing no Rockfon policy).

³⁰² AWI00374862.

³⁰³ McCatty Deposition at 38-39 ("Q: When did GMS purchase Ryan Building Materials? A: October 31st of 2016. Q: And as part of that deal, GMS told you that Ryan yards could no longer carry Rockfon tile; correct? A: Yeah, that's correct." . . . Q: And at the time did this bother you? A: We weren't happy about it. Q: Why? A: We'd rather have more manufacturers than less, so...").

Ryan Building Materials stopped buying Rockfon SACTs almost immediately after being acquired by GMS and becoming subject to the “No Rockfon” agreement between GMS and Armstrong. Notably, Armstrong never began selling SACTs to Ryan Building Materials.

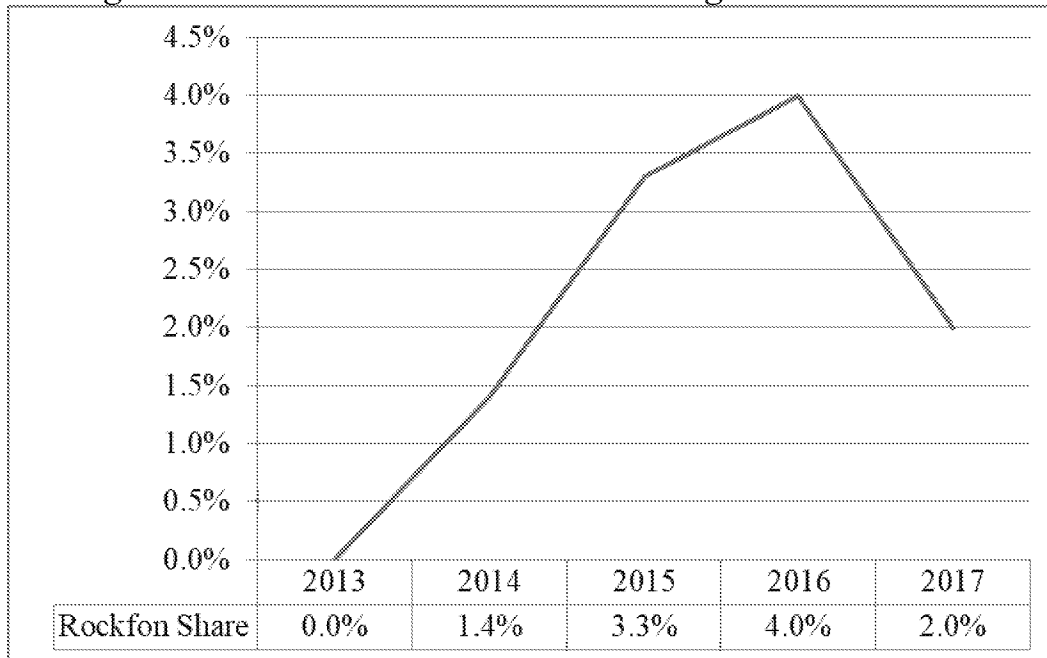
Figure 17: Rockfon and Armstrong SACT Sales to Ryan Building Materials³⁰⁴



199. Regional sales data shows that the foreclosure of Ryan Building Materials stunted Rockfon’s growth in the East Michigan Price Metro. Figure 18 shows Rockfon’s share of SACT revenue in the East Michigan Price Metro. It shows that Rockfon’s share increased steadily while it had access to Ryan Building Materials of a distributor from 0% in 2013 to 4.0% in 2016. However, Ryan Building Materials became foreclosed at the end of 2016 (November 2016), and consequently Rockfon’s share in the East Michigan Price Metro not only stopped growing, but actually decreased from 4.0% in 2016 to 2.0% in 2017.

³⁰⁴ “ROXARM44 Ryan Building Materials AWI Rockfon SACT purchases.csv”.

Figure 18: Rockfon Share in East Michigan Price Metro³⁰⁵



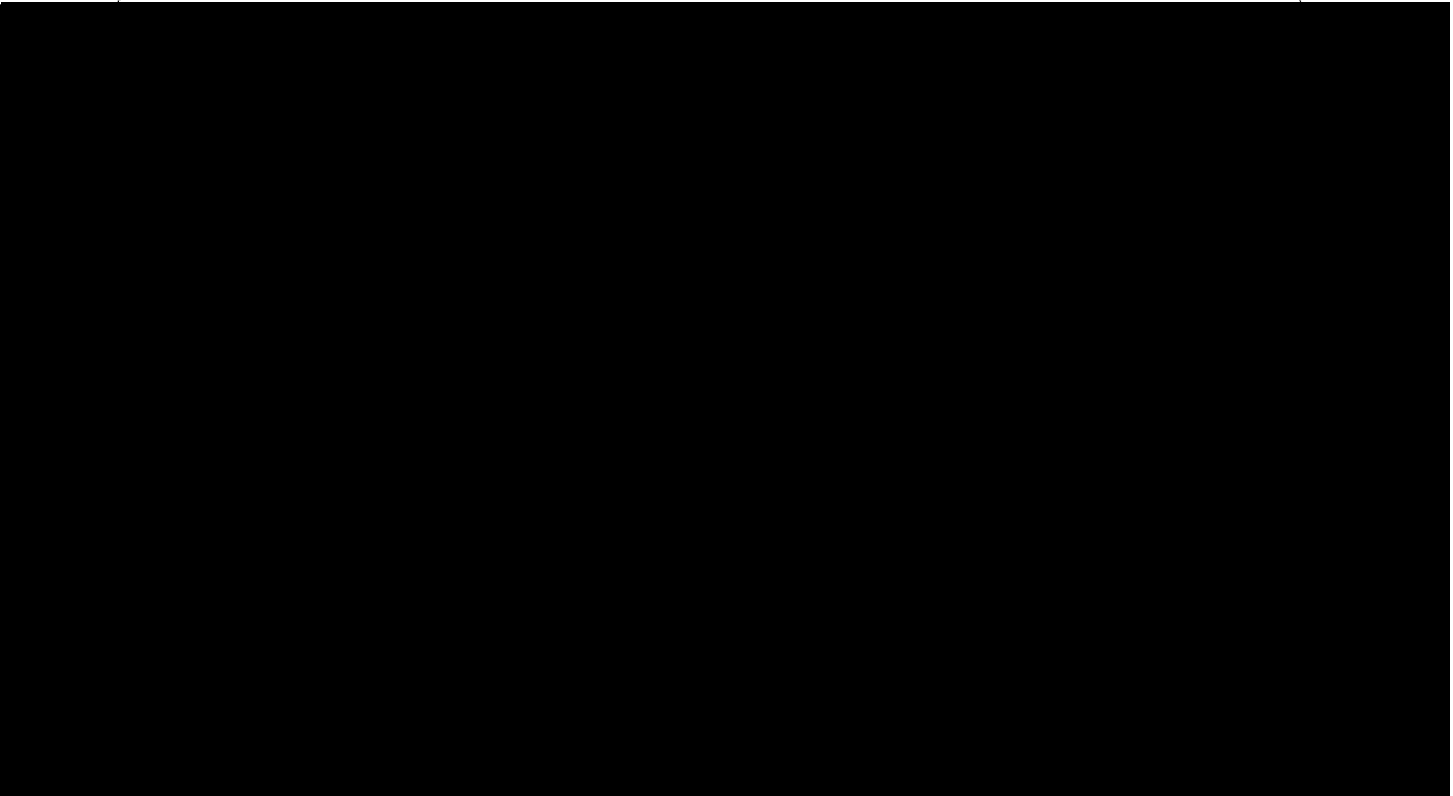
200. **b. Gypsum Supply in Lansing, Michigan.** Gypsum Supply in Lansing Michigan was unforclosed until it was purchased by GMS on January 12, 2016,³⁰⁶ therefore making it subject to the preexisting “No Rockfon” agreement between Armstrong and GMS. Figure 19 below shows that Gypsum Supply was purchasing significant amounts of Rockfon SACTs while it was unforclosed, and then completely stopped buying Rockfon SACTs after it was purchased by GMS. Rockfon’s growth has been stagnant in the West Michigan Price Metro; its market shares there from 2014-2017 were 0.0%, 0.6%, 1.1%, and 1.1%.³⁰⁷

³⁰⁵ “ROXARM65 Rockfon Regional Shares 2013-2017.csv”.

³⁰⁶ <http://www.prweb.com/releases/2016/01/prweb13156516.htm>.

³⁰⁷ “ROXARM65 Rockfon Regional Shares 2013-2017.csv”.

Figure 19: Gypsum Supply Lansing SACT Purchases of Rockfon and Armstrong³⁰⁸



201. **c. Badgerland in Wisconsin.** GMS acquired Badgerland on December 4, 2015,³⁰⁹ which made Badgerland subject to the preexisting agreement between Armstrong and GMS prohibiting all GMS locations from carrying Rockfon.³¹⁰ About six months after GMS acquired Badgerland (i.e., about May 2016) GMS told the employees at Badgerland that they could no longer purchase Rockfon SACTs.³¹¹ Badgerland then stopped buying Rockfon SACTs and instead sold only CertainTeed SACTs, when it had previously sold both Rockfon and CertainTeed SACTs.³¹²

³⁰⁸ “ROXARM44 Gypsum Supply Lansing AWI Rockfon SACT purchases.csv”.

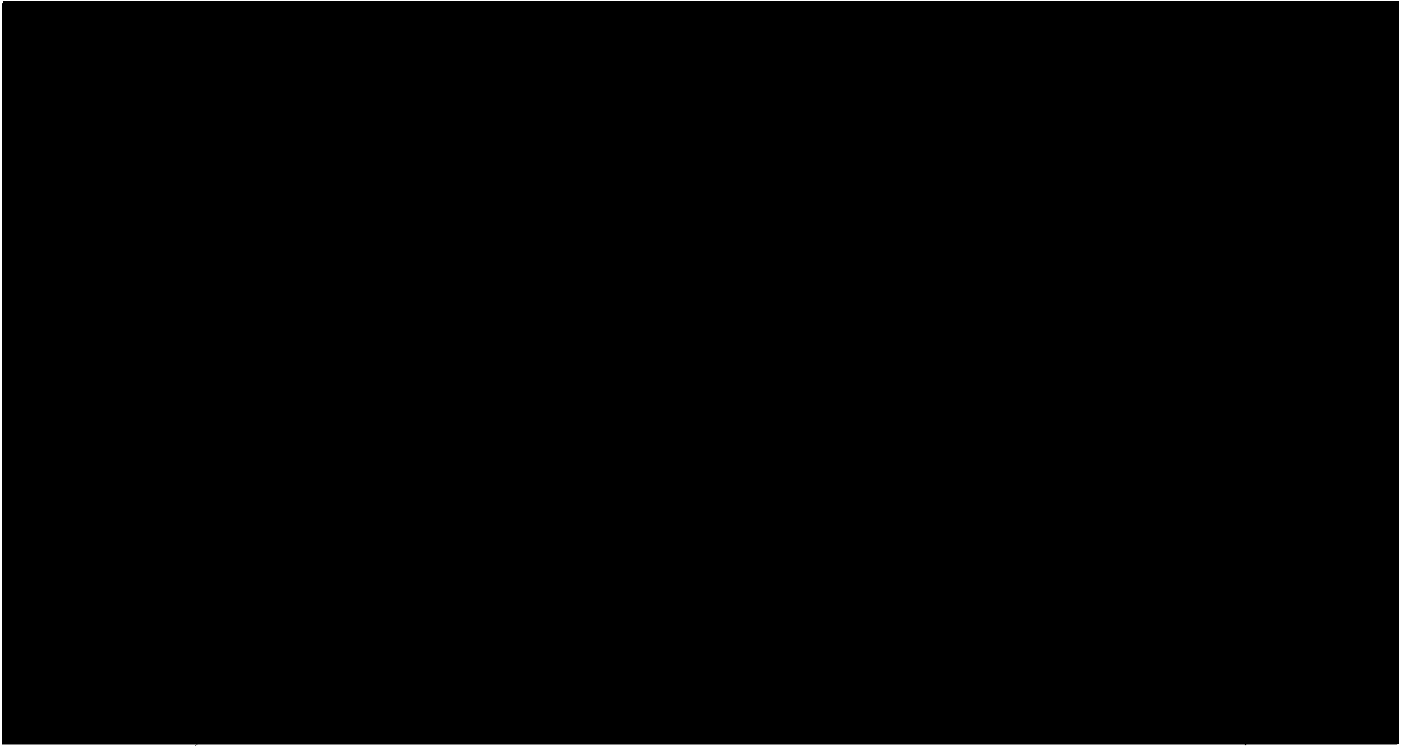
³⁰⁹ www.globalgypsum.com/news/item/1140-gypsum-management-and-supply-gms-acquires-badgerland-supply.

³¹⁰ See *supra* Part I.B.

³¹¹ Downing (Badgerland) Deposition at 11 (“A: . . . after the acquisition [by GMS] was when we were . . . told that we could no longer support Rockfon ceiling tile”); *id.* at 12 (“Q: How long after the purchase [of Badgerland by GMS] did Mr. Brown [of GMS] tell you that you could no longer support Rockfon tile? A: I think it was within the first six months”).

³¹² Downing (Badgerland) Deposition at 10-11 (“A: Badgerland Supply had been a CertainTeed ceiling distributor and a CMC, Chicago Metallic Corp., grid distributor. . . . CMC was acquired by . . . Rockfon, and we continued to buy that product because CertainTeed didn’t have a – an available line at the time. When Rockfon brought out their ceiling tile line, because

Figure 20: Badgerland/Tamarack of Wisconsin Purchases of Armstrong and Rockfon SACTs³¹³



202. Rockfon has never gained a significant share in the Wisconsin Price Metro in which Badgerland resides. Rockfon's shares of revenue from 2014-2017 were 0.1%, 0.5%, 0.5%, and 1.1%, respectively.³¹⁴

203. **d. Rockwise Building Materials in Dewey, Arizona.** Until July 2016, Rockwise was unencumbered and was purchasing significant amounts of Rockfon SACTs. However, on July 6, 2016, GMS acquired Rockwise,³¹⁵ making Rockwise subject to the preexisting "No Rockfon" agreement between Armstrong and GMS. Armstrong acknowledged internally that this acquisition would force

we had their grid, it was made available to us, and we – we also added that to our – our product line . . . So we had both Rockfon and CertainTeed products in stock prior to the acquisition.”).

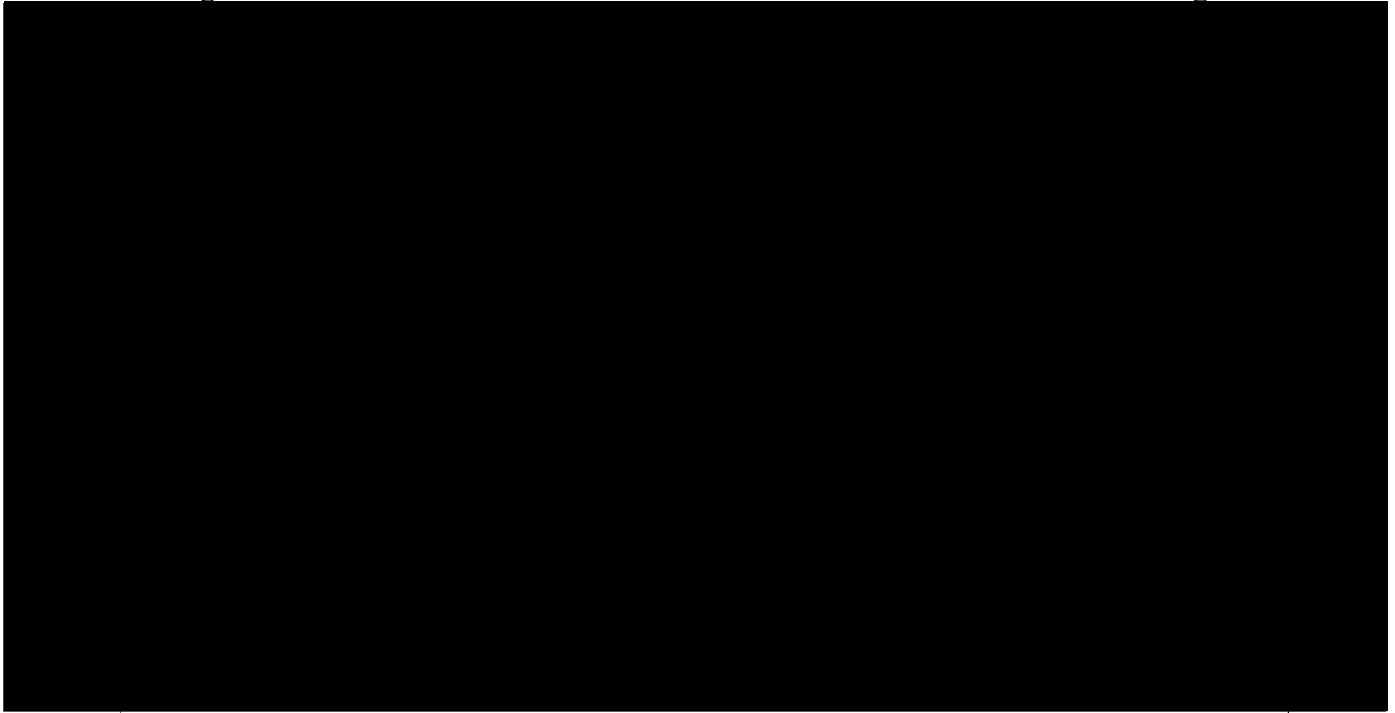
³¹³ “ROXARM44 Badgerland Tamarack Wisconsin AWI Rockfon Purchases.csv”.

³¹⁴ “ROXARM65 Rockfon Regional Shares 2013-2017.csv”.

³¹⁵ See investor.gms.com/file/Index?KeyFile=34992118 (July 6, 2016 public statement by GMS announcing acquisition of Rockwise).

Rockwise to stop distributing Rockfon.³¹⁶ Figure 21 below confirms that Rockwise stopped purchased Rockfon SACTs after it was acquired by GMS.

Figure 21: Rockwise SACT Purchases of Rockfon and Armstrong³¹⁷



204. Sales data indicates that foreclosing Rockfon from access to Rockwise stunted Rockfon's growth in the Phoenix Price Metro. Rockfon's share in the Phoenix Price Metro initially increased from 0% in 2014 to 1.3% in 2015, but Rockwise became foreclosed halfway through 2016 and its Rockfon's share then decreased to only 0.6% in 2016.³¹⁸ Rockfon's share in the Phoenix metro increased slightly to 1.6% in 2017.³¹⁹

³¹⁶ AWI01414067 (June 30, 2016 internal Armstrong email stating "Now that Rockwise is owned by GMS, and Rockfon can no longer be distributed by them. It sounds like Rockfon is looking for anyone to distribute their line").

³¹⁷ "ROXARM44 Rockwise AWI Rockfon SACT purchases.csv".

³¹⁸ "ROXARM65 Rockfon Regional Shares 2013-2017.csv".

³¹⁹ *Id.*

D. Statistics Confirming That the Foreclosure Slowed Rockfon's Growth

1. Combined Effect of Armstrong and USG Foreclosure

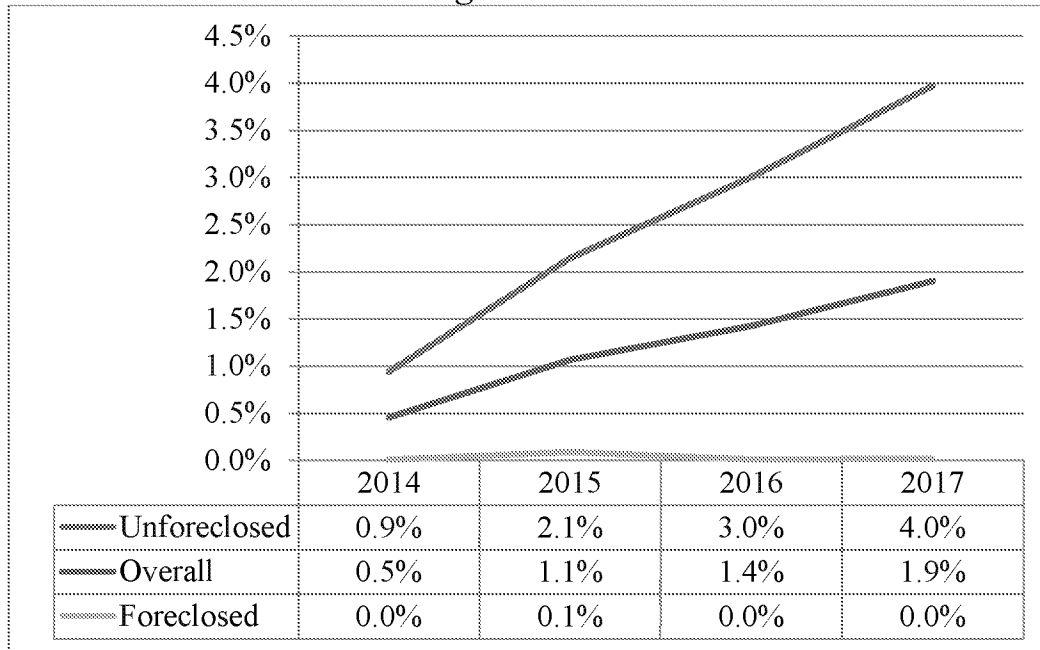
205. Manufacturer sales data shows that Rockfon grew significantly faster among unforeclosed customers than among foreclosed customers. Figure 22 below shows Rockfon's market share (measured in terms of square feet) in the U.S. at three groups: (1) all customers overall;³²⁰ (2) customers foreclosed by Armstrong or USG agreements;³²¹ and (3) customers not foreclosed by Armstrong or USG agreements.³²² It shows that Rockfon essentially did not grow at all among customers foreclosed by Armstrong agreements—Rockfon's share among foreclosed customers was 0.1% or less in every year from 2014-2017. In contrast, Rockfon share increased steadily by about 1 percentage point per year among customers that were not foreclosed by Armstrong or USG agreements. This indicates that the foreclosure caused by Armstrong and USG's agreements significantly slowed Rockfon's growth.

³²⁰ I calculate Rockfon's share of all customers overall as: total Rockfon SACT ft² in the United States divided by total SACT ft² in the United States.

³²¹ I calculate Rockfon's share of all customers foreclosed by Armstrong or USG agreements as: Rockfon SACT sales to customers foreclosed either by Armstrong or USG divided by the sum of: (1) Armstrong SACT sales to customers foreclosed by Armstrong or USG; (2) Rockfon SACT sales to customers foreclosed by Armstrong or USG; and (3) USG SACT sales to customers foreclosed by Armstrong or USG. Even though some CertainTeed sales were likely foreclosed by Armstrong, I conservatively assume that no CertainTeed sales are foreclosed by Armstrong because CertainTeed did not produce customer-level data that would allow me to identify which CertainTeed sales were foreclosed.

³²² I calculate Rockfon's share of all customers not foreclosed by Armstrong or USG agreements as: Rockfon SACT sales to customers not foreclosed by Armstrong or USG divided by the sum of: (1) Armstrong SACT sales to customers not foreclosed by Armstrong or USG agreements; (2) Rockfon SACT sales to customers not foreclosed by Armstrong or USG agreements; (3) USG SACT sales to customers not foreclosed by Armstrong or USG agreements; and (4) all CertainTeed SACT sales. For reasons noted in the preceding footnote, including all CertainTeed SACT sales as unforeclosed is conservative, given that some were foreclosed by Armstrong, but I include them all as unforeclosed because CertainTeed did not produce customer-level data that would allow me to identify which CertainTeed sales were foreclosed.

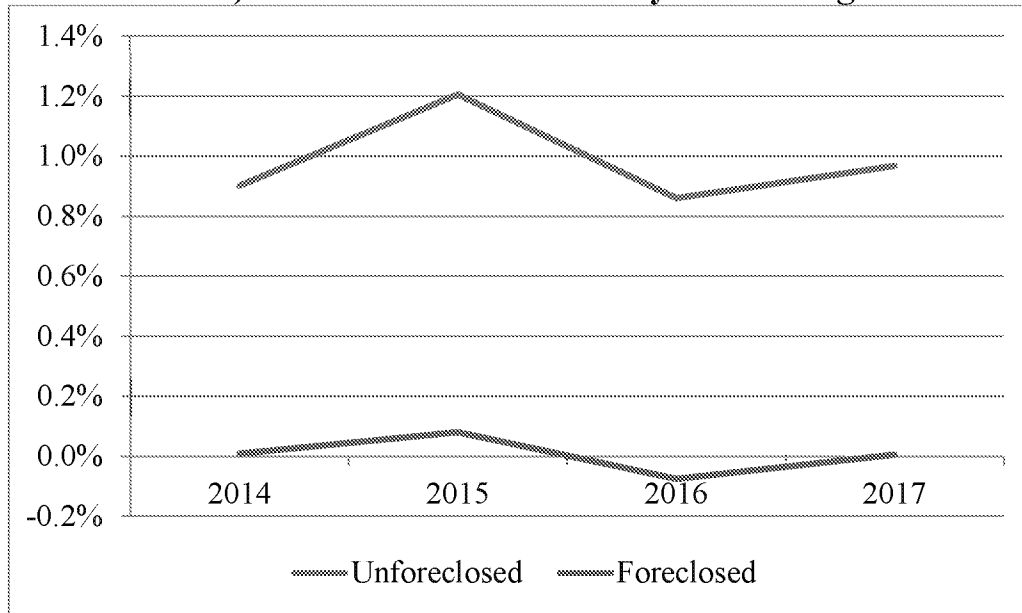
Figure 22: Rockfon Share of Square Feet: Customers Foreclosed by Armstrong or USG vs. Not³²³



206. Using this same data, Figure 23 below shows that the percentage point growth in Rockfon's share of SACT sales (current share minus previous year's market share) was about 1% per year among customers not foreclosed by Armstrong or USG agreements, versus 0% among customers foreclosed by Armstrong or USG agreements.

³²³ "ROXARM94 forc unforc shares awiorusg.csv". These figures do not change significantly if one incorrectly assumes that Armstrong's tailored minimum purchase requirements are not foreclosing. Under such an assumption, Rockfon's share among foreclosed customers is still never greater than 0.1% in any year, whereas Rockfon's share among unforeclosed customers increases from 0.9% in 2014 to 3.7% in 2017. "ROXARM94 forc unforc shares awiorusg nomin.csv".

Figure 23: Growth in Rockfon Share (Difference Between Current Share and Previous Year Share): Customers Foreclosed by Armstrong or USG vs Not³²⁴



207. Comparing Rockfon’s growth between foreclosed and unforeclosed customers separately for each regional market within the United States also confirms that Rockfon grew significantly faster among unforeclosed customers. Using the same methodology described above, I calculated Rockfon’s SACT market share separately for foreclosed and unforeclosed customers in each regional market within the United States and for each year. I then ran the following regression:

$$\text{RockfonShareGrowth}_{yrf} = b_0 + b_1 * \text{ForeclosedByArmOrUSG}_{yrf} + a_y$$

208. In this regression, the dependent variable $\text{RockfonShareGrowth}_{yrf}$ equals Rockfon’s share in year y , in region r , and for customers with foreclosed status f (0 for unforeclosed, 1 for foreclosed), minus Rockfon’s share in the same region and amongst customers with the same foreclosed status in the previous year.³²⁵ The independent variable of interest, $\text{ForeclosedByArmOrUSG}_{yrf}$, is equal to 0 for sales to customers not foreclosed by Armstrong or USG and 1 for sales to customers foreclosed by Armstrong or USG. I also include yearly fixed effects (represented as a_y). This regression estimates that the coefficient b_1 is -1.1%,

³²⁴ “ROXARM94 growth forc unforc awiorusg.csv”.

³²⁵ For example, if Rockfon’s share in region r among unforeclosed customers was 5% in 2014 and 2% in 2013, then $\text{RockfonShareGrowth}_{yrf}$ would equal 3% (5%-2%) in 2014 for the unforeclosed group in region r .

indicating that Armstrong and USG's foreclosing agreements reduce Rockfon's annual share growth in the regional markets by on average 1.1 percentage point (e.g., a reduction in growth from 1.2 percentage points per year to 0.1 percentage points per year) in any given year, relative to unforeclosed customers.³²⁶ This is a large effect given that the maximum overall share Rockfon has achieved as of 2017 is only 1.9%. The p-value with respect to a null-hypothesis of no effect is less than 0.001% when calculated with robust standard errors,³²⁷ confirming that this result is statistically significant. This region-level regression analysis further confirms that Armstrong and USG's foreclosing agreements have significantly slowed Rockfon's growth

2. Isolated Effect of Armstrong Foreclosure

209. Even if one ignores the foreclosure caused by USG's agreements, the data still shows that Rockfon grew significantly faster among customers that were not foreclosed by Armstrong agreements than among customers who were foreclosed by Armstrong agreements. Figure 24 below shows Rockfon's square-foot market share in the U.S. at three groups: (1) all customers overall;³²⁸ (2) customers foreclosed by Armstrong agreements;³²⁹ and (3) customers not foreclosed by Armstrong agreements.³³⁰ It shows that Rockfon essentially did not grow at all among customers foreclosed by Armstrong agreements—Rockfon's

³²⁶ "ROXARM74a regional growth forc by awiorusg v not regression.txt".

³²⁷ "ROXARM74a regional growth forc by awiorusg v not regression.txt".

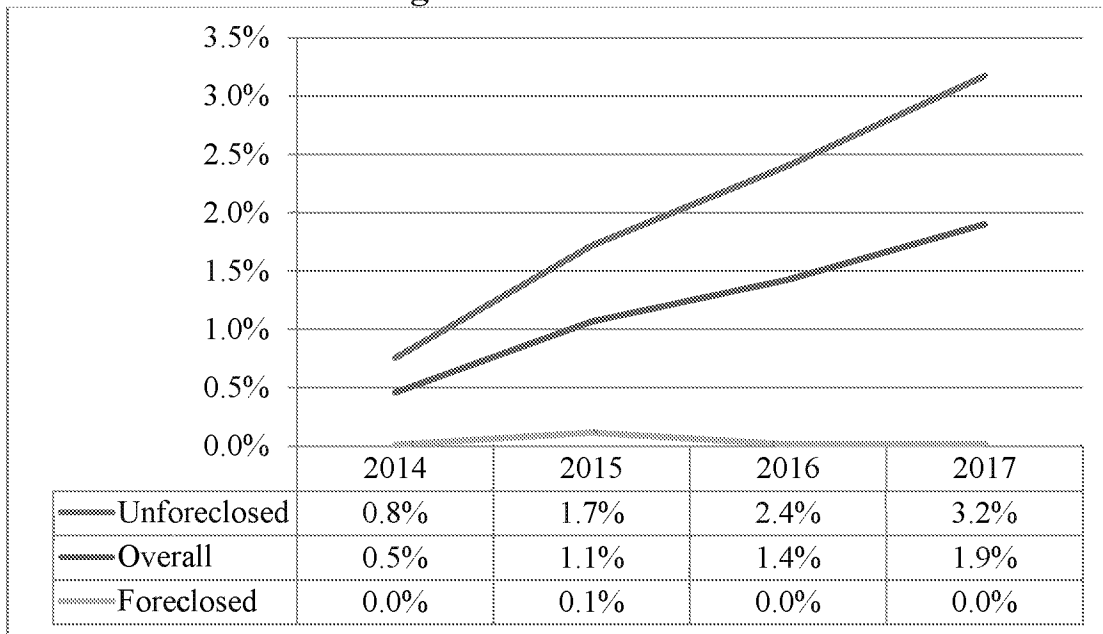
³²⁸ I calculate Rockfon's share of all customers overall as: total Rockfon SACT ft² in the United States divided by total SACT ft² in the United States.

³²⁹ I calculate Rockfon's share of all customers foreclosed by Armstrong agreements as: Rockfon SACT sales to customers foreclosed by Armstrong divided by the sum of: (1) Armstrong SACT sales to customers foreclosed by Armstrong; (2) Rockfon SACT sales to customers foreclosed by Armstrong; and (3) USG SACT sales to customers foreclosed by Armstrong. Even though some CertainTeed sales were likely foreclosed by Armstrong, I conservatively assume that no CertainTeed sales are foreclosed by Armstrong because CertainTeed did not produce customer-level data that would allow me to identify which CertainTeed sales were foreclosed.

³³⁰ I calculate Rockfon's share of all customers not foreclosed by Armstrong agreements as: Rockfon SACT sales to customers not foreclosed by Armstrong divided by the sum of: (1) Armstrong SACT sales to customers not foreclosed by Armstrong agreements; (2) Rockfon SACT sales to customers not foreclosed by Armstrong agreements; (3) USG SACT sales to customers not foreclosed by Armstrong agreements; and (4) all CertainTeed SACT sales. For reasons noted in the prior paragraph, including all CertainTeed SACT sales as unforeclosed is conservative, given that some were foreclosed by Armstrong, but I include them all as unforeclosed because CertainTeed did not produce customer-level data that would allow me to identify which CertainTeed sales were foreclosed.

share among foreclosed customers was 0.1% or less in every year from 2014-2017. In contrast, Rockfon share increased steadily by about 0.8 percentage points per year among customers that were not foreclosed by Armstrong agreements. This indicates that the foreclosure caused by Armstrong's agreements significantly slowed Rockfon's growth.

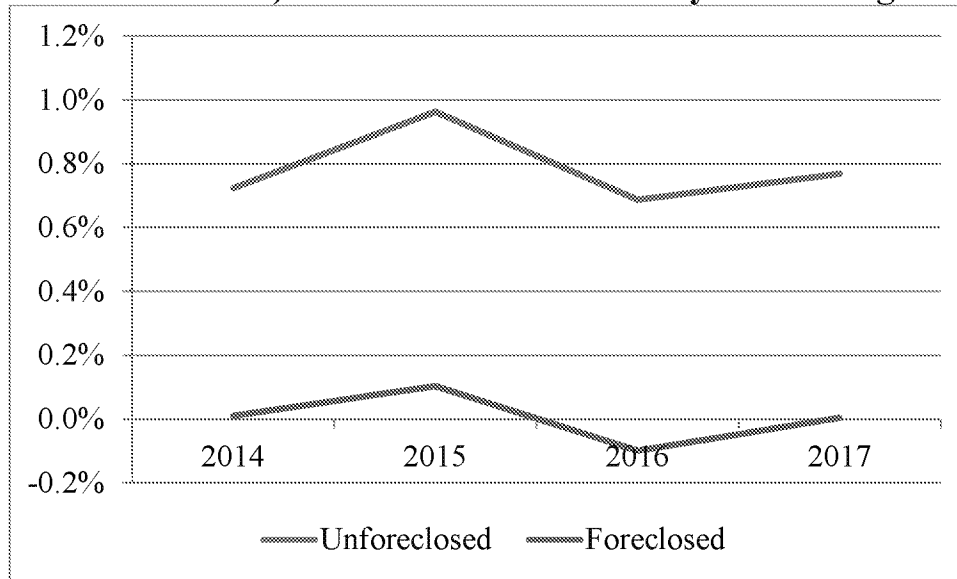
Figure 24: Rockfon Share of Revenue: Customers Foreclosed by Armstrong Agreements vs Not³³¹



210. Using this same data, Figure 25 below shows that the percentage point growth in Rockfon's share of SACT sales (current share minus previous year's market share) was about 0.8% per year among customers not foreclosed by Armstrong agreements, versus 0% among customers foreclosed by Armstrong agreements.

³³¹ "ROXARM94 forc unforc shares awionly.csv". These figures do not change significantly if one conservatively assumes that Armstrong's minimum purchase agreements do not foreclose rivals. Under such an assumption, Rockfon's share among foreclosed customers ranges from 0.0-0.1% from 2014 to 2017, whereas its share among unforeclosed customers increases significantly each year from 2014 to 2017 in the following order: 0.7%, 1.6%, 2.3%, 3.0%. "ROXARM94 forc unforc shares awinomin.csv".

Figure 25: Growth in Rockfon Share (Difference Between Current Share and Previous Year Share): Customers Foreclosed by Armstrong vs Not³³²



211. Comparing Rockfon’s growth between customers foreclosed by Armstrong versus not foreclosed by Armstrong separately for each regional market within the United States also confirms that Rockfon grew significantly faster among unforeclosed customers. Using the same methodology described above, I calculated Rockfon’s SACT market share separately for customers foreclosed by Armstrong and customers not foreclosed by Armstrong in each regional market within the United States and for each year. I then ran the following regression:

$$\text{RockfonShareGrowth}_{yrf} = b_0 + b_1 * \text{ForeclosedByArm}_{yrf} + a_y$$

212. In this regression, the dependent variable $\text{RockfonShareGrowth}_{yrf}$ equals Rockfon’s share in year y , in region r , and for customers with foreclosed status f (0 for unforeclosed, 1 for foreclosed), minus Rockfon’s share in the same region and amongst customers with the same foreclosed status in the previous year.³³³ The independent variable of interest, $\text{ForeclosedByArm}_{yrf}$, is equal to 0 for sales to customers not foreclosed by Armstrong and 1 for sales to customers foreclosed by Armstrong. I also include yearly fixed effects (represented as a_y). This regression estimates that the coefficient b_1 is -0.8%, indicating that Armstrong’s foreclosure reduces Rockfon’s annual share growth in the regional

³³² “ROXARM94 growth forc unforc awionly.csv”.

³³³ For example, if Rockfon’s share in region r among unforeclosed customers was 5% in 2014 and 2% in 2013, then $\text{RockfonShareGrowth}_{yrf}$ would equal 3% (5%-2%) in 2014 for the unforeclosed group in region r .

markets by on average 0.8 percentage points (e.g., a reduction in growth from 1.0 percentage points per year to 0.2 percentage points per year) in any given year, relative to customers unforeclosed by Armstrong.³³⁴ This is a large effect given that the maximum overall share Rockfon has achieved in the United States as of 2017 is only 1.9%. The p-value with respect to a null-hypothesis of no effect is less than 0.001% when calculated with robust standard errors,³³⁵ confirming that this result is statistically significant. This region-level regression analysis further confirms that Armstrong's foreclosing agreements have significantly slowed Rockfon's growth.

3. Rockfon's Slower Growth Among Foreclosed Customers Cannot Be Explained by Factors That Equally Affect Foreclosed and Unforeclosed Customers

213. These statistics showing that Rockfon grew significantly faster among unforeclosed customers refutes Armstrong's claims that Rockfon's lack of growth is due to alleged deficiencies in Rockfon's products or product breadth, because these claimed deficiencies apply equally to foreclosed and unforeclosed customers. For example, to the extent that Rockfon's growth were slowed by its SACTs' lower average CACs (even though Rockfon does have high CAC SACTs like the Sonar dB),³³⁶ that factor would slow Rockfon's growth both at unforeclosed customers and foreclosed customers, given that Rockfon's product offering does not differ between foreclosed and unforeclosed customers. For this same reason, Rockfon's slower growth among foreclosed customers cannot be due to Rockfon's lack of a "fissured" SACT,³³⁷ because both foreclosed and unforeclosed customers are unable to buy a fissured SACT from Rockfon. Nor can Rockfon's slower growth among foreclosed customers be attributed to Armstrong being specified in more projects than Rockfon,³³⁸ given that specifications apply equally to all distributors and contractors that service a job, regardless of whether they are foreclosed or unforeclosed by Armstrong. Nor can Rockfon's slower growth among foreclosed customers be attributed to Rockfon importing its SACTs from Poland (instead of producing domestically), because the same was true for its unforeclosed customers.

³³⁴ "ROXARM74a regional growth forc by awi v not regression.txt".

³³⁵ "ROXARM74a regional growth forc by awi v not regression.txt".

³³⁶ Kahler Deposition at 144-145 (Armstrong counsel questioning a Rockwool employee about Rockfon's CAC levels).

³³⁷ Kahler Deposition at 95-96 (Armstrong counsel questioning a Rockwool employee about Rockfon not having a fissured SACT).

³³⁸ Armstrong Motion to Dismiss at 13.

214. Further, it is important to note that these statistics are conservatively biased against a finding that Rockfon grows faster among unforced customers for two reasons. *First*, these statistics assume that all CertainTeed sales are unforced, when in reality some CertainTeed sales were forced by Armstrong's "No-Rockfon" agreements with GMS and FBM that applied to non-Armstrong locations. These CertainTeed sales to forced customers should be included in the "forced" group in this statistics, but because CertainTeed has not produced customer-level data I cannot determine which CertainTeed sales are to forced rather than unforced customers, and conservatively assume that they are all unforced. The inclusion of these actually forced CertainTeed sales in the "unforced" group in my analysis artificially reduces the estimate of Rockfon's share among the unforced group (because it adds additional non-Rockfon sales to the denominator of the unforced group) and artificially increases the estimate of Rockfon's share among the forced group (because it removes some non-Rockfon sales from the denominator of the forced group).³³⁹ *Second*, because USG has not produced contracts for customers other than L&W, FBM, and GMS, I conservatively assume that all other USG sales are unforced, even though there is documentary evidence that USG generally requires all of its distributors to be exclusive. If USG's sales to customers other than L&W, FBM, and GMS are actually forced, then these statistics further understate Rockfon's share among unforced customers and further overstate Rockfon's share among forced customers.

IV. ANTICOMPETITIVE HARM

215. Armstrong's foreclosure of rival SACT manufacturers has harmed competition in multiple ways, described in the following sections. Armstrong's foreclosure harms competition primarily by disadvantaging rivals (primarily Rockfon) in a way that reduces the competitive constraint rivals impose on

³³⁹ Mathematically, Rockfon's actual share among unforced customers = $R_u / (A_u + U_u + C_u + R_u)$, where R_u , A_u , U_u , and C_u are Rockfon's, Armstrong's, USG's, and CertainTeed's sales among unforced customers, respectively. Rockfon's actual share among forced customers is correspondingly $R_f / (A_f + U_f + C_f + R_f)$, where R_f , A_f , U_f , and C_f are the firms' sales among forced customers. Because CertainTeed has not produced customer-level data, I conservatively assume that all CertainTeed sales are unforced, which makes my estimate of Rockfon's unforced share instead $R_u / (A_u + U_u + C_u + C_f + R_u)$, which is necessarily lower than Rockfon's actual share among unforced customers because C_f is positive and added to the denominator. This conservative assumption also makes my estimate of Rockfon's forced share instead $R_f / (A_f + U_f + R_f)$, which is necessarily higher than Rockfon's actual share among forced customers, again because C_f is positive and removed from the denominator.

Armstrong, thereby allowing Armstrong to maintain elevated prices without losing market share.³⁴⁰ Indeed, Armstrong's expert economist in this case, Professor Ordover, has acknowledged in his academic writing that this is one of the standard ways in which a dominant firm can harm competition:

"As part of profit maximization, a firm's management can engage in potentially anticompetitive conduct [by] engag[ing] in practices that disadvantage actual rivals, without necessarily causing their exit, but which relax the competitive constraint exercised by them over the dominant firm.)"³⁴¹

A. Foreclosure Impaired Rockfon's Ability to Compete By Delaying Rockfon's Investment in a Domestic Manufacturing Plant

216. As I explain in more detail below in Part VII, because Armstrong's foreclosure slowed Rockfon's sales growth in North America, it also in turn delayed when it would become profit-maximizing for Rockfon to open its domestic manufacturing plant. The delay in the opening of Rockfon's domestic manufacturing plant impaired Rockfon's ability to compete in multiple ways, described below.

1. Delaying Domestic Manufacturing Plant Increased Rockfon's Transportation Costs

217. The cost to Rockfon of obtaining SACTs in North America is generally lower if Rockfon manufactures them in North America instead of importing them from Poland because domestic production avoids the cost of shipping the SACTs across the Atlantic Ocean from Europe.³⁴² Specifically, an

³⁴⁰ Einer Elhauge, U.S. Antitrust Law & Economics 371 (3d ed. 2018) ("the major anticompetitive concern is that [exclusive dealing] agreements might foreclose[] enough of the market to rivals as to impair competition. Such foreclosure might impede rival efficiency, entry, existence, or expandability, any of which can anticompetitively increase the market power of the foreclosing firm.").

³⁴¹ Ordover & Saloner, *Predation, Monopolization and Antitrust*, Chapter 9 in Handbook of Industrial Organization, Volume I (1989) at 541.

³⁴² ROXUL_4487337 at ROXUL_4487341 ("VPC in MAR [U.S. plant] will be higher than the current cost from CIG [Polish plant], but it is more than offset by the savings on ocean freight").

internal Rockfon documents predicted that the total cost of importing SACTs from Poland (including ocean freight) would be about 10% higher than the cost of producing SACTs domestically.³⁴³ Similarly, Rockfon cost data indicates that its total acquisition costs (including ocean freight) were on average 24% higher for the same SACTs when imported from Poland than when manufactured in the United States.³⁴⁴ Thus, delaying the building and opening of Rockfon's domestic manufacturing plant increased Rockfon's incremental transportation costs.

218. The increase in Rockfon's incremental transportation costs caused by delaying the domestic Rockfon manufacturing plant harms consumers in two main ways: (1) it causes the rival's profit-maximizing price to increase because a firm's profit-maximizing price is higher the higher its incremental costs; and (2) the resulting increase in the rival's profit-maximizing price allows the incumbent firms to charge higher prices, because an incumbent firm's profit-maximizing price is higher the higher its rivals' prices are.³⁴⁵ Indeed, Professor Ordoover has acknowledged in his academic writing that dominant firms can harm competition through "the use of 'sabotage' by the incumbent to put the rival at a competitive disadvantage," by "raising the rival's costs."³⁴⁶ This anticompetitive increase in Rockfon's incremental transportation costs thus increases Rockfon's and Armstrong's prices throughout North America.

2. Delaying Domestic Manufacturing Plant Increased Rockfon's Lead Times

219. Delaying the opening of Rockfon's domestic manufacturing plant also had the anticompetitive effect of increasing Rockfon's lead times because it takes roughly 4-8 weeks for SACTs produced in Poland to cross the Atlantic Ocean and clear customs.³⁴⁷ This increase in Rockfon's lead times caused by delaying the

³⁴³ ROXUL_4487337 at ROXUL_4487341 (document predicting that cost of obtaining a certain amount of SACTs from Poland ("Cig") was \$27,328 in production costs plus \$9,844 in Ocean Freight for a total of \$37,172, which is 10% higher than the cost of producing this same amount of SACTs in Mississippi plant (\$33,561).

³⁴⁴ "ROXARM31 average Poland cost premium.csv". This statistic is weighted by feet squared and focuses on the combination of months and product models in which both SACTs manufactured from Poland and SACTs manufactured in Mississippi were sold.

³⁴⁵ In some cases, the increase in the rival's incremental cost can also force the rival to exit the market altogether, but that is not true here.

³⁴⁶ Ordoover & Saloner, *Predation, Monopolization and Antitrust*, Chapter 9 in Handbook of Industrial Organization, Volume I (1989) at 565.

³⁴⁷ ROXUL_4487337 ("The successful growth of ROCKFON in north America requires investment in local production for three primary reasons [...] 2. Long term management of an 8

domestic Rockfon manufacturing plant not only harms Rockfon customers, who must experience longer lead times, but also Armstrong customers because Rockfon provides less of a competitive constraint on Armstrong when its lead times are longer.

3. *Delaying Domestic Manufacturing Plant Reduced Customer Demand for Rockfon SACTs*

220. Delaying Rockfon's domestic manufacturing plant impaired Rockfon's competitiveness also by reducing customer demand for Rockfon SACTs in North America and the U.S. in particular. Internal Rockfon documents acknowledge that "the U.S. market clearly has a preference for U.S.-made products," which implies that demand for Rockfon SACTs are lower when they are produced outside the U.S.³⁴⁸ Further, an internal Rockfon document explains that distributors in the U.S. are less likely to carry Rockfon SACTs before Rockfon has a domestic manufacturing plant because "distributors see local production as a necessary show of ROCKWOOL's commitment to the market."³⁴⁹ This reduction in the demand for Rockfon SACTs harms consumers because it makes Rockfon a less effective competitor and therefore less of a constraint on Armstrong's prices.

B. Foreclosure Continues to Impair Rockfon's Production Efficiency By Depriving Its Domestic Manufacturing Plant of Economies of Scale

221. Even after the domestic manufacturing plant in Marshall, Mississippi became operational, there were still additional economies of scale to be gained through expanding SACT output at the Marshall location. The reduction in

week supply chain is not feasible for a market where lead times [...] are less than 1 week"); John Medio (Rockfon President) 30(b)(6) Dep. at 48:16-49 ("A. Ideally we'd like to supply all products from domestic manufacturing. Q. And is there a reason for that? [...] A. Basically to alleviate the supply chain challenges we discussed earlier. It's hard to manage a supply chain across an ocean. Q. What are the difficulties that pop up when you're managing a supply chain across the ocean that are – A. Hurricanes, port strikes, I don't know, weather. When you have 4 weeks of transit time, and you know, additional transit time, it's just always difficult to plan a supply chain. So we'd like to alleviate that.").

³⁴⁸ ROXUL_4487337 at ROXUL_4487340 (Kadkol Exhibit 26) ("The U.S. market clearly has a preference for U.S.-made products").

³⁴⁹ ROXUL_4487337 ("The successful growth of ROCKFON in north America requires investment in local production for three primary reasons. [...] 3. Distributors see local production as a necessary show of ROCKWOOL's commitment to the market. Without it, they will not take the risk of carrying ROCKFON as their sole ceilings brand.").

Rockfon's North American sales due to Armstrong's conduct thus continued to impair Rockfon's efficiency even after the Marshall plant was built, and will continue to do so even after the Marshall facility's learning curve is completed.

222. Rockfon was already seriously considering adding an additional SACT production line at the Marshall facility within months of the original line starting production in July 2017.³⁵⁰ A "pre-project" approved in early October 2017 was to examine adding a second line at the Marshall facility.³⁵¹ This same document explains that a prior analysis had determined that "the optimal alternative to meet the forecasted growth in North America" would involve adding this second line in 2020 followed by an extension of this line in 2022.³⁵² This demonstrates that by October 2017, Rockfon was already considering adding and then extending an additional line at the Marshall location over the next five years. As of October 2018, Rockfon was still determining whether to move forward with the second line, but they are "seriously evaluating" doing so, with the "earliest" it could be completed being "some point in late 2019."³⁵³ Rockfon President John

³⁵⁰ See AWI00013662 (Jul. 14, 2017 internal Armstrong email, copying a Rockfon press release announcing that "Production started today at Rockfon's first North America manufacturing facility in Marshall County, Mississippi.").

³⁵¹ ROXUL_5739547 ("Investment request" approved in early October 2017 "to complete a Pre-Project to implement [a] 2nd Rockfon Line in MAR (Orion Project).").

³⁵² ROXUL_5739547 at ROXUL_5739551 ("Velazquez SNP evaluated various scenarios and concluded that the optimal alternative to meet the forecasted growth in North America would be to implement a CITO line focused only on A & E Edges in 2020, to be followed by a 2nd E-Ring on the CITO line with Spray Cabin in 2022. This alternative provided the best IRR (25%) and maximized capacity by focusing the CITO line on A & E edge products.").

³⁵³ See John Medio (Rockfon President) Personal Dep. (Oct. 2, 2018) at 246:21-247:20 ("Q. What is MAR Cito, C-I-T-O? A. It's a second line in MAR that resembles the Cito line in Poland. Q. And is that the project that you are considering now? A. Yes. Q. But you have no estimate as to when you will make a decision to go forward with that project? A. Correct. Q. What's the lead time on that project? A. The lead time of building the factory, you mean? Q. Uh-hum. A. It's hard to say. Q. What's the minimum lead time? A. I would say 12 months. Q. So the earliest that that factory or that line could be built would be at some point in late 2019? A. Yes. Q. Is that an option you are seriously evaluating? A. Yes."). See also Prabodh Kadkol (Rockfon VP of Operations) Dep. (Sept. 12, 2018) at 85:19-86:22 ("Q. The last one on there is Orion line installation. Do you see that? A. Yes. Q. And that one isn't scheduled to start until 2019, correct? A. Correct. Q. Does it actually mean -- they're going to actually be installing an Orion line starting in January 2019? A. That was the anticipation at that time. Q. It's not going to happen? A. There's a chance it won't happen. Q. Is there an investment request related to Orion? A. There's -- we don't have one right now, no. Q. Okay. For the Orion line to be installed, there would have to be an approved investment request to the board of directors, correct? A. Correct. Q. And that has not happened? A. That has not happened. Q. When do

Medio confirmed that “what would lead [the second line] to be necessary” would be “[i]ncreased demand in ceiling tiles.”³⁵⁴ This demonstrates that even if Rockfon does not go ahead with adding the second line at Marshall in 2019, this will be as a result of the suppressed demand brought about by Armstrong’s conduct. In a but-for world free of this conduct it would be profit-maximizing to add a second line at the Marshall facility earlier, for the same reasons that it would have been profit-maximizing to build the original Marshall line earlier in the but-for world.

223. The availability of economies of scale on additional SACT lines at the Marshall facility is demonstrated by their availability on additional SACT lines that achieved economies of scale at the Polish facility. A 2012 report proposed expanding capacity by adding a third line to the two lines already at the Polish facility because of, among other reasons, “econom[ies] of scale.”³⁵⁵ Both the original Marshall manufacturing facility³⁵⁶ and the potential second line³⁵⁷ at that facility are modeled on lines at the Polish facility, meaning the economies of scale available at the Polish facility would also be available at the Marshall facility. Rockfon has thus continued to be harmed by artificially reduced demand for its SACTs even after completing the first Marshall line, as restrained actual-world

you anticipate an investment request related to Orion being submitted to the board? A. Sometime late 2018.”).

³⁵⁴ See John Medio (Rockfon President) Personal Dep. at 245:6-14 (“Q. And what is the MAR 2nd E-ring? A. It’s an extension we can do to the production line. Q. And is that something that you’re intending to do? A. Don’t know yet. Haven’t fully analyzed whether it’s necessary. Q. And what would lead it to be necessary? A. Increased demand in ceiling tiles.”).

³⁵⁵ ROXUL_0255407 (“Report for RI Board Meeting 2012: Draft Business plan Rockfon capacity extension) at ROXUL_0255411 (“The CITO confection line will be placed in Cigacice (Poland) where Rockfon has already 2 confectioning lines. The reason for choosing Cigacice as the place for new capacity is the following: - Well established organization that already knows how to work with Rockfon production -- concentration of knowledge, and economy of scale ...”). Report was attached to ROXUL_0255406 (Apr. 15, 2012 internal email).

³⁵⁶ Prabodh Kadkol (Rockfon VP of Operations) Dep. at 78:12-20 (“Q. The first bullet under that bullet is: All equipment installed is exact copy of existing Cito line in CIG. Do you see that? A. Yes. Q. Is it your understanding that the equipment installed at the Marshall plant was an exact copy of the Cito line in CIG? A. Yes, from a general design point of view.”).

³⁵⁷ John Medio (Rockfon President) Personal Dep. at 246:21-23 (“Q. What is MAR Cito, C-I-T-O? A. It’s a second line in MAR that resembles the Cito line in Poland.”). See also Prabodh Kadkol (Rockfon VP of Operations) Dep. at 58:15-59:2 (“Q. Okay. Is there -- I think you testified earlier there’s a plan to introduce a second line at Marshall; is that right? A. There’s no plan. There is a review going on of potentially adding a second line. Q. And what would that second line be? A. Another tile manufacturing line. Q. Similar to Gjall or similar to Panel? A. It’s not hundred percent decided; but most likely it will be similar to the Cito line, as you were referring to.”).

demand delayed its realization of economies of scale on additional SACT production lines at the Marshall location.

C. Regional Foreclosure Raised Rockfon's Distribution Costs and Impaired Regional Distribution Competition

224. I showed above in Part III.A.3 that Armstrong and USG's agreements foreclosed at least [REDACTED]% of all SACT sales (whether made to distributors or other customers) in [REDACTED] regional markets within the United States from 2016 to 2017, and in [REDACTED] of the 61 regional markets from 2013 (the one exception being the West Texas region, which is the third-smallest in the U.S.). Moreover, [REDACTED] of the regions had [REDACTED]% or greater foreclosure shares, and [REDACTED] of the regions had [REDACTED]% or greater foreclosure shares (depending on the year).³⁵⁸ These high foreclosure shares show that Armstrong was significantly foreclosing access to distribution in essentially every regional market within the U.S. This created anticompetitive effects not only by depriving Rockfon of the most efficient distributors in a way that raised Rockfon's distribution costs, but also by reducing regional competition in a way that raised regional prices. Thus, regions in which regional competition were impaired suffered anticompetitive harms above and beyond the anticompetitive harms suffered throughout North America due to the ways in which the foreclosure impaired Rockfon's ability to compete throughout North America, discussed in the previous parts A and B.

225. **a. Because Armstrong and USG Foreclosed Access to the Most Efficient Distributors, Rockfon Often Had to Turn to Less Efficient Distributors.** Because Armstrong and USG foreclosed access to many of the most efficient distributors, Rockfon has had to attempt to sell its SACTs through less effective distributors on multiple occasions. For example, Rockfon has often had to sell its SACTs through distributors of insulation products, who lack specialized knowledge about SACTs and preexisting relationships with ceilings contractors (who tend to be different from insulation contractors).³⁵⁹ As another example, a

³⁵⁸ See *supra* Part III.A.3 for more summaries of foreclosure shares under various alternative assumptions about which agreements are foreclosing.

³⁵⁹ Noeth (Rockfon) Deposition at 205-206 ("Q: Has Rockfon built any distributors from scratch? A: We have not built any distributors. We have distributors that, when we get kicked out of somewhere, we end up having to start somewhere else, and those restarts have been, a lot of times, with folks that don't really know ceilings that well and we try to build them up. Q: Is IDI an example? A: IDI is an example of –yeah, a company that was mostly insulation-focused, would not be our idea of an ideal ceilings distributor, but if you look at the markets where we

distributor in Eastern Michigan testified that, after Armstrong foreclosed Rockfon from access to Ryan Building Materials, there were “not many” distributor options left to Rockfon in the region, and the only ones left were “smaller, more residential dealers,” who typically did not fulfill large projects.³⁶⁰ Forcing Rockfon to use these less efficient means of distribution impairs Rockfon’s ability to compete, as confirmed by Armstrong deposition testimony that “not having a top quality distributor” will “absolutely” make it harder to sell SACTs.³⁶¹

226. Antitrust economics has long recognized that foreclosing rivals from the most efficient means of distribution harms competition, even if it does not deprive rivals of economies of scale.³⁶² Preventing rivals from using the most efficient means of distribution harms consumers in multiple ways, including: (1) making the rival less appealing to consumers, who are forced to use less efficient means of distribution to access the rival products; (2) increasing rivals’ costs of distribution, which in turn increases the rival’s profit-maximizing prices; and (3) allowing the incumbent firms to maintain supracompetitive prices because of effects (1) and (2), which reduce the competitive constraint the rival imposes on incumbent prices. This is an example of the sort of “sabotage by an incumbent to put a rival at a competitive disadvantage” that Professor Ordover has acknowledged is anticompetitive.³⁶³

227. **b. Armstrong Employees Acknowledge That Depriving Rockfon of Access to Regional Distribution Raises Regional Prices.** Armstrong’s Director of Pricing for Ceiling Tiles testified in deposition that the ability of a

operate with them, it was probably because that was our only option after the changes that were forced on us through the Armstrong pressures”).

³⁶⁰ McCatty Deposition at 43-44.

³⁶¹ Galvin (Armstrong) Deposition at 166 (“Q: And by having not a top quality distributor, did that make it harder for you to sell Armstrong ceiling tiles? A: Absolutely.”).

³⁶² Einer Elhauge, U.S. Antitrust Law & Economics 371 (3d ed. 2018)(“even if rivals are able to achieve their minimum efficient scale and scope of production, foreclosure that bars rivals from the most efficient suppliers or means of distribution can also impair rival efficiency by increasing their costs.”); HOVENKAMP, FEDERAL ANTITRUST POLICY 431 (2d ed. 1999); Krattenmaker & Salop, *Anticompetitive Exclusion*, 96 YALE L.J., 234-45 (1986); Stephen C. Salop & David T. Scheffman, *Raising Rivals’ Costs*, 73 AM. ECON. REV. 267 (1983) (Special Issue).

³⁶³ Ordover & Saloner, *Predation, Monopolization and Antitrust*, Chapter 9 in Handbook of Industrial Organization, Volume I (1989) 565 (“in this section we turn to actions which involve the use of ‘sabotage’ by the incumbent to put the rival at a competitive disadvantage. This goal can be accomplished by raising the rival’s costs or by impairing its ability to generate demand for its product.”).

competing manufacturer to constrain Armstrong's prices depends on that manufacturer's market share in a region, which turns in part on access to distribution.³⁶⁴ Thus, the testimony of Armstrong's own Pricing Director indicates that foreclosing Rockfon from access to distributors will reduce Rockfon's share in the region, which will in turn reduce Rockfon's ability to constrain Armstrong's prices in that region. Armstrong employees also expressed the belief that allowing Rockfon significant access to distribution would force Armstrong to reduce its prices in contemporaneous documents. For example, an Armstrong Area Manager emailed a regional distributor in July 2014 to say that there would be an "adverse [e]ffect to the market of distributing Rockfon" in the form of "price erosion."³⁶⁵ Similarly, Armstrong's Vice President of Sales for the Eastern U.S. emailed distributors in October 2013 to say that "someone [a distributor] taking on Rockfon" has "the potential for market erosion for all parties."³⁶⁶

228. Armstrong's own prediction of these anticompetitive effects on regional prices is again consistent with antitrust economics, which finds that regional foreclosure can impede regional competition in a way that raises regional prices even if the foreclosure does not raise rivals' costs.³⁶⁷ Accentuating this

³⁶⁴ McKinney (AWI Director of Pricing for Ceiling Tiles) Deposition at 61-63 ("



³⁶⁵ AWI00368595.

³⁶⁶ AWI00066852.

³⁶⁷ ELHAUGE, U.S. ANTITRUST LAW & ECONOMICS 373-374 (3d ed. 2018) ("foreclosure can take the form of seller-buyer collaboration to exploit downstream buyers by precluding rival competition. Suppose, for example, that a seller of widgets on a national market pays the only ten retailers in a regional market \$1 million each to agree to exclusively sell the seller's product, thus foreclosing competition from rival widget makers. With a regional monopoly, the seller can now raise prices on its widgets to supracompetitive levels to retailers in that market, which those retailers will pass on without fear that the higher prices will cause them to lose market share to other retailers because they all have the same agreement. In effect, the exclusionary agreements here allow the seller to serve as a regional cartel ringmaster, splitting the resulting supracompetitive profits with the retailers. The anticompetitive effect does not require that the foreclosure impair rival efficiency in any of the other ways indicated above. It suffices that the foreclosure precludes competition that would otherwise have constrained market power in a

anticompetitive effect, foreclosing Rockfon from a regional market impairs competition more than foreclosing Armstrong's other rivals because Rockfon is a "maverick" competitor in the SACT markets. As I showed above in Part I.D, Rockfon is a "maverick" competitor in two ways: (1) Rockfon generally prices more aggressively (lower) than Armstrong, USG or CertainTeed; and (2) Rockfon offers unique products. Indeed, Armstrong's contract terms with FBM and GMS that prohibit non-Armstrong locations from carrying Rockfon in particular (but allow those same locations to carry CertainTeed or USG) would be economically rational only if Armstrong believed that Rockfon posed a competitive constraint that USG and CertainTeed did not.

229. **c. Foreclosure of Rockfon in Particular Deprives Customers of the Benefits of Rockfon's Unique Products and Armstrong's "Defensive" Products.** As I explained above in Part I.D, Rockfon has introduced unique products to the North American SACT market, in particular affordable smooth-surfaced SACTs with high NRCs. Rockfon's products were so unique that Armstrong had to develop "defensive" SACTs in response in order to compete against Rockfon. Armstrong internal policies show [REDACTED]

[REDACTED] Consequently, customers only get the benefit of Rockfon's unique SACTs and Armstrong's less-expensive defensive products if Armstrong has to compete against Rockfon. Therefore, when Armstrong's foreclosure of distributors prevents Rockfon from competing for a job, or hampers Rockfon's ability to compete for a job by foreclosing the most efficient distributors, customers do not even get the opportunity to buy Armstrong's less-expensive defensive products.

V. ABSENCE OF OFFSETTING PROCOMPETITIVE EFFICIENCIES

230. In antitrust economics, a type of conduct has procompetitive efficiencies if it benefits customers in a way that could not be achieved by a less restrictive alternative. In contrast to anticompetitive conduct, which increases a firm's profits by reducing competition from rivals, procompetitive conduct

downstream regional market"); Krattenmaker & Salop, *supra* note 362, at 238–40; Elizabeth Granitz & Benjamin Klein, *Monopolization by Raising Rivals' Costs: The Standard Oil Case*, 39 J.L. & ECON. 1 (1996); Hovenkamp, *Mergers & Buyers*, 77 VA. L. REV. 1369 (1991); IV AREEDA, HOVENKAMP & SOLOW, *ANTITRUST LAW* ¶ 943b, 204–06 & n.4 (1998).

increases a firm's profits by making the firm's products more attractive to customers, for example by reducing price or improving product quality. Although exclusive dealing agreements can have procompetitive effects in some cases, I have not found evidence that those procompetitive effects exist in this case.

231. a. No Evidence that Exclusive Agreements Have Incentivized Dealers to Promote Its Exclusive Brand in a Way that Benefits Consumers.

Armstrong has argued that its exclusive dealing agreements with distributors are procompetitive because they could “lead[] dealers to promote each manufacturer’s brand more aggressively than would be the case under nonexclusive dealing’ such that the quality-adjusted price to the consumer ‘(where quality includes the information and other services the dealers render to their customers) may be lower with exclusive dealing than without.’”³⁶⁸ Although an exclusive dealing agreement will incentivize the dealer to promote the exclusive manufacturer’s brand more aggressively, that aggressive promotion of a single brand does not necessarily benefit consumers. Indeed, such exclusive agreements actually provide dealers an incentive to provide distorted or misleading information to consumers in an attempt to convince consumers that the exclusive brand is best, given that the distributor will lose the customer’s business if the customer chooses a brand that the distributor is not allowed to carry.

232. b. No Evidence that Exclusive Agreements Were Necessary to Incentivize Armstrong Investments in Dealers that Would Benefit Consumers.

Armstrong argued in its motion to dismiss that its exclusive dealing agreements are procompetitive because they “prevent free-riding on the substantial investments that manufacturers (like Armstrong) make with distributors to promote their own products.”³⁶⁹ To begin with, Armstrong frames this theoretical procompetitive efficiency incorrectly. There is nothing procompetitive about preventing rivals from “free-riding” on a manufacturer’s promotional efforts; a rival manufacturer benefiting from another manufacturer’s promotional activities does not harm consumers in any way. Rather, the theory that Armstrong’s counsel is alluding to is that exclusive dealing can sometimes have the procompetitive effect of incentivizing the manufacturer to engage in promotional activities that the manufacturer would not engage in but-for the exclusivity requirement. Thus, the key question is not whether other manufacturers (or their distributors) “free ride” on investments Armstrong makes in dealers, but rather whether Armstrong would make those same investments if it were not allowed to engage in exclusive dealing.

³⁶⁸ Armstrong Motion to Dismiss at 17.

³⁶⁹ Armstrong Motion to Dismiss at 17.

233. Here, the evidence indicates that exclusive dealing is *not* necessary to induce manufacturer investments in distributors, and therefore that Armstrong's exclusive dealing agreements do not have the procompetitive effect of increasing manufacturer investments in distributors. Rockfon provides extensive training to its distributors but does not require distributors to be exclusive to Rockfon,³⁷⁰ which indicates that exclusivity agreements are not necessary to incentivize manufacturers to provide training to distributors.

234. **c. No Evidence That Armstrong's Exclusive Dealing Agreements Assured Supply for Distributors or Consumers.** Armstrong has argued that its exclusive dealing agreements are procompetitive based on the premise that they "assure supply" to distributors,³⁷¹ but in this case Armstrong's exclusive dealing agreements actually made supply less stable for distributors. Armstrong's distributor agreements include standard language that gives Armstrong the right to "limit the distribution of, or discontinue Ceiling Products at any time, without notice and without liability to distributor or distributor's customers."³⁷² Thus, Armstrong's agreements did not assure supply to its distributors in any way. Moreover, Armstrong's exclusivity requirements made distributors' access to Armstrong products less dependable because they allowed Armstrong to terminate all supply of its products if the distributor bought SACTs from rival manufacturers.

235. **d. No Evidence that Armstrong's Exclusive Dealing Agreements Assured Price Stability for Distributors or Consumers.** Armstrong has argued that its exclusive dealing agreements "assure price stability" to distributors,³⁷³ but

³⁷⁰ Medio (Rockfon 30(b)(6)) Deposition at 238-39 ("Q: What type of training or educational assistance does Rockfon provide to its distributors? A: We provide all kinds of training and education to our distributors, ranging from simple product training and education, you know as simple as a presentation around a table like this with the distribution salespeople, counter-salespeople, counter-salespeople on just what are the products, what do they do, basic of it to more elaborate things we call customer experience visits, where we bring distributors or distributors and contractors or contractors to Chicago for 2 days, and there's 2 days of trainings and presentations and some social activity, but – and then anything in between. We've done demos for contractors at locations. We do, I could argue, a lot of tradeshow, local tradeshow events are trainings of some kind.").

³⁷¹ Armstrong Motion to Dismiss at 17 (Exclusive dealing agreements can assure supply").

³⁷² See, e.g., AWI00069482 at AWI00069482. This is Section 9 of most Armstrong distributor agreements.

³⁷³ Armstrong Motion to Dismiss at 17 (exclusive dealing agreements can "assure . . . price stability").

Armstrong's distributor agreements actually do not provide any terms that protect distributors from price increases. For example, I have not seen any terms in Armstrong's distributor agreements that prohibit Armstrong from raising prices by more than a certain percentage per year, or any other similar terms.

236. **e. Prohibiting Even Distributor Locations That Do Not Sell Armstrong From Selling Rockfon Evinces Anticompetitive Purpose.** The fact that Armstrong restricts distributors from purchasing from a particular rival (here Rockfon) even when those distributors do not purchase from Armstrong is unequivocally anticompetitive. Because Armstrong does not sell any SACTs to these distributors, these restrictions by definition cannot be justified as necessary to induce procompetitive Armstrong investments in those distributors or Armstrong price reductions to those distributors. In other words, prohibiting non-Armstrong distributors from buying SACTs from Rockfon could be profitable for Armstrong only if this prohibition had the anticompetitive effect of reducing Rockfon's ability to compete, constrain Armstrong's prices, and battle against Armstrong for market share.

237. **f. USG Foreclosing Agreement with L&W Not Procompetitive Either.** I have also not seen evidence indicating that USG's exclusive dealing agreement with L&W is procompetitive. [REDACTED]

[REDACTED]³⁷⁴ If it were actually efficient and procompetitive to require distributors to exclusively sell a single manufacturer's building materials, then one would expect [REDACTED]

[REDACTED] Thus, the fact that [REDACTED] indicates that these exclusive dealing agreements are not driven by procompetitive efficiencies.

³⁷⁴ USG-0000326 at USG-0000327 [REDACTED]

[REDACTED]”).

VI. DAMAGES

238. Plaintiff counsel has asked me to calculate the profits Rockfon lost due to Armstrong’s anticompetitive conduct from January 1, 2014 to December 31, 2018 within the United States. To calculate damages, I calculate Rockfon’s profits in the actual world and compare those to Rockfon’s profits in the but-for world. In Section A below, I calculate Rockfon’s actual and but-for revenues. In Section B below, I calculate Rockfon’s actual and but-for profit margins. Lastly, in Section C I calculate Rockfon’s actual profits and subtract those from Rockfon’s but-for profits.

A. Rockfon Revenues in Actual and But-for Worlds

239. I can directly calculate Rockfon’s actual U.S. revenues from 2014 to 2017, but must project its total actual revenues in 2018 because Rockfon’s sales data ends partway through June 2018. Rockfon sales data shows that its actual revenues from January-May of a given year have consistently been about █% of Rockfon’s total revenues for the year,³⁷⁵ meaning that one can reasonably project Rockfon’s full-year 2018 actual revenues by dividing its revenues in January through May of 2018 by █%. This methodology indicates that Rockfon’s total U.S. SACT revenue for 2018 will be approximately \$█.

Table 19: Actual Rockfon SACT Revenue in the U.S. (With Anticompetitive Foreclosure)³⁷⁶	
Year	Actual Rockfon Revenue
2014	█
2015	█
2016	█
2017	█
2018 (partly projected)	█

240. A conservative benchmark for how much SACTs Rockfon would sell in the but-for world (where there would be no anticompetitive foreclosure) is Rockfon’s actual share of sales of SACTs to unforced customers. This is a

³⁷⁵ “ROXARM93 jan_thru_may 2015-2017 pct of full year.csv”. Rockfon’s actual revenues in January through May were equal to █% of its total revenues in 2015 and 2016, and █% of its total revenues in 2017. “ROXARM93 jan_thru_may as percent of full year historical.csv”.

³⁷⁶ “ROXARM93 actual Rockfon US SACT revenue 2014-2018.csv”.

highly conservative benchmark that understates damages because even Rockfon's sales among unforeclosed customers were anticompetitively reduced by the ways in which Armstrong and USG's foreclosing agreements impaired Rockfon's ability to compete for all customers, foreclosed or unforeclosed. Namely, I showed above in Part IV that the foreclosure impaired Rockfon's ability to compete for all customers by: (1) increasing Rockfon's incremental costs of acquiring SACTs; (2) increasing Rockfon's lead times; and (3) reducing demand for Rockfon SACTs throughout the United States. Rockfon's share among unforeclosed customers in the actual world is therefore a highly conservative floor on Rockfon's but-for market share. Because those foreclosure effects all suppressed Rockfon's share of sales to unforeclosed customers, using that unforeclosed share as the benchmark for Rockfon's but-for sales make my damages estimates a highly conservative floor on Rockfon damages.

241. Using the same methodology I used to calculate Figure 22 above in Part III.D, Table 20 below shows that Rockfon's square foot share among customers unforeclosed by Armstrong or USG was 2.0-2.1 times its overall square foot share from 2014-2017, depending on the year. This indicates that Rockfon's total revenue would have been about 2.0-2.1 times higher but for the foreclosure caused by Armstrong and USG. USG and CertainTeed have not produced any data for 2018, and Armstrong and Rockfon have only produced data for parts of 2018, so I cannot directly calculate Rockfon's shares amongst foreclosed and unforeclosed customers for 2018. I therefore use the multiplier for 2017 to calculate but-for sales in 2018.

Table 20: Rockfon Square Foot Share Among Customers Not Foreclosed by Armstrong or USG, Divided by Its Overall Share³⁷⁷			
Year	Unforeclosed Share [a]	Overall Share [b]	Multiplier [c] = [a]/[b]
2014	0.94%	0.46%	2.1
2015	2.14%	1.07%	2.0
2016	3.00%	1.43%	2.1
2017	3.97%	1.90%	2.1
2018	--	--	2.1

242. Table 21 below multiplies this ratio (of Rockfon's unforeclosed to total share) by Rockfon's actual revenue to produce an estimate of Rockfon's but-

³⁷⁷ "ROXARM93 multiplier formula awiorusg.csv".

for revenue. Rockfon's lost revenue equals its but-for revenue minus its actual revenue.

Table 21: Rockfon U.S. SACT Revenue: Actual versus But-for Armstrong and USG Foreclosing Agreements³⁷⁸			
Year	Multiplier [c]	Actual Revenue [d]	But-for Revenue [e] = [c]*[d]
2014	2.1		
2015	2.0		
2016	2.1		
2017	2.1		
2018	2.1		

243. Table 22 below shows Rockfon's lost revenues from 2014 to 2018 under varying assumptions about the foreclosing conduct that would exist in the but-for world.

Table 22: Rockfon U.S. But-for SACT Revenues Under Varying Assumptions About Foreclosure in But-for World³⁷⁹				
Year	But-for Armstrong and USG Foreclosure	But-for Armstrong- Only Foreclosure	But-for Armstrong and USG Foreclosure (Excluding Min Purchase)	But-for Armstrong Foreclosure (Excluding Min Purchase)
2014				
2015				
2016				
2017				
2018				

244. I show below in Part VII that Rockfon had the capacity necessary to supply this additional demand in the but-for world.

³⁷⁸ "ROXARM93 actual but-for revenues formula awiorusg.csv".

³⁷⁹ "ROXARM93 but-for revenues.csv".

245. For purposes of my damages calculation of Rockfon's lost profits, I conservatively assume that Rockfon would have kept its but-for prices at the same level as its actual prices even though Rockfon's per-unit incremental costs would have been lower in the but-for world. This assumption is conservative for purposes of calculating lost profits because a but-for cost decrease would have caused Rockfon to lower its but-for prices from actual levels only if that price adjustment would have further increased its but-for volume enough to increase its but-for total profits, given the standard economic assumption that firms maximize profits. Thus, if the but-for decrease in per-unit incremental costs would have caused Rockfon to reduce but-for prices below actual levels, it would only be because the combination of that price reduction and cost reduction would have increased its but-for total profits more than keeping its prices the same and just earning a larger profit per sale because of the lower per-unit incremental costs. Ignoring the fact that lower per-unit costs could have led Rockfon to lower but-for prices thus means I am conservatively assuming that Rockfon would not have further increased its but-for volume and total profits by lowering its prices to reflect those lower costs.

B. Incremental Profit Margins in Actual and But-for Worlds

246. For this damages analysis, the only costs that are relevant are costs that would vary between the actual and but-for worlds. The relevant costs are therefore only Rockfon's incremental costs; i.e., the costs that increase with additional units sold. In contrast, non-incremental costs such as marketing, salesforce, accounting, and IT costs would be the same in the actual and but-for worlds, even though Rockfon's sales would be significantly higher in the but-for world.

247. Section 1 below calculates Rockfon's actual incremental profit margin. Section 2 calculates Rockfon's but-for incremental profit margin, which is higher because Rockfon's incremental cost per unit would be lower in the but-for world. These incremental profit margins all exclude non-incremental costs that would have been the same in the but-for world as in the actual world.

1. Actual Rockfon Incremental Profit Margins

248. Rockfon's incremental costs of selling additional SACTs fall into two main categories: (a) obtaining additional SACTs, and (b) distributing additional SACTs to customers.

249. **a. Rockfon Cost of Obtaining Additional SACTs.** For SACTs produced in the Rockwool plant in Poland, Roxul USA pays Rockwool the "Gross Transfer Price" ("GTP") for each SACT that it purchases from its parent company.³⁸⁰ Roxul USA must also pay the "Ocean Freight" cost of shipping the tile from Europe to the United States. I determine the GTP using Rockfon's transactional data, which directly indicates the GTP of every sale. Rockfon's cost data does not explicitly list its cost of ocean freight in each year, so I deduce it using a combination of Rockfon's transactional data and profit and loss data.³⁸¹ I ultimately find that the cost of Ocean Freight per square foot of tile was [REDACTED] in 2014, [REDACTED] in 2015, [REDACTED] in 2016, and [REDACTED] in 2017.³⁸² I therefore calculate the total cost of obtaining SACTs from Poland by adding this deduced Ocean Freight cost per square foot to the GTP indicated in Rockfon's transactional data. For SACTs produced in Rockfon's Mississippi plant, the acquisition cost is simply the GTP because there is no need to freight them across the ocean. Table 23 below shows Rockfon's actual average cost of acquiring SACTs in each year, as a

³⁸⁰ Rockwool calculates the "GTP" as the variable production cost "VPC" plus the "B markup" (fixed cost and line maintenance attributed to production of the product), "C markup" (depreciation attributed to the production of the product), and "F markup" (profit margin for the factory that made the tile).

³⁸¹ The "Tile Material Costs" reported in Rockfon's product-line P&L statements (up until October 2017, when Rockfon also began producing SACTs in the U.S.) equals the Variable Production Cost ("VPC") plus the Ocean Freight costs. The Gross Transfer Price in the Rockfon transaction data equals the VPC plus the B, C, and F markups indicated in Rockfon's Profit and Loss data. Therefore one can calculate the VPC as $GTP - (B, C, E, F \text{ Markups})$ and the Ocean Freight as the "Tile Material Costs" minus the calculated VPC.

³⁸² "Ocean Freight VPC Deduction.xlsx" shows these calculations and the sources I rely upon. Because I lack Ocean Freight data for 2013 and 2018, I assume that the 2013 cost of ocean freight per square foot equals the 2014 cost of ocean freight per square foot, and assume that the 2018 cost of ocean freight per square foot equals the 2017 cost of ocean freight per square foot. These Ocean Freight costs I deduce from Rockfon's Profit and Loss and transaction data are consistent with other estimates of Rockfon's ocean freight costs I have seen in Rockfon's internal data. For example, ROXUL_5571846, tab "NPV & PL" indicates that the predicted cost of inbound ocean freight would be 11 cents per square foot in 2015 and 13 cents per square foot in 2016 (calculated by dividing "Inbound ocean freight" row by "RFN tile 000 ft" row)

percentage of net SACT sales. I show below in Section 2 that these costs would be lower in the but-for world due to savings on ocean freight costs.

Table 23: Actual Rockfon Costs of Obtaining Incremental SACTs as a % of Net SACT Sales³⁸³			
Year	Ocean Freight	GTP	GTP + Ocean Freight
2014			
2015			
2016			
2017			
2018			

250. **b. Rockfon Cost of Distributing Additional SACTs.** After obtaining additional SACTs, Rockfon must then also distribute them to customers. These distribution costs are Rockfon's outbound freight costs and warehousing costs. Because I do not have outbound freight and warehousing cost data for 2018, I use Rockfon's 2017 freight and warehousing costs when calculating Rockfon's 2018 costs.

Table 24: Rockfon Warehouse and Outbound Freight Costs as a Percentage of Net SACT Sales³⁸⁴		
Year	Warehouse	Outbound Freight
2014		
2015		
2016		
2017		
2018		

251. **c. Total Actual Rockfon Incremental Costs.** Table 25 below shows Rockfon's total incremental costs of selling additional SACTs in each year, calculated as a percentage of net SACT sales. It also shows Rockfon's actual implied profit margin on additional SACT sales in each year, which equals 100% minus the total incremental costs measured as a percentage of net sales.

³⁸³ "ROXARM48 acquisition cost as a pct of netsales.csv".

³⁸⁴ "ROXARM48 warehouse and outbound freight costs as pNetSales.csv".

Table 25: Rockfon Total Actual Incremental Costs as Percentage of Net Sales, and Implied Profit Margin³⁸⁵					
Year	Acquisition Cost	Warehouse	Outbound Freight	Total Incremental Cost	Implied Profit Margin
2014					
2015					
2016					
2017					
2018					

2. But-for Rockfon Incremental Profit Margins

252. Without anticompetitive foreclosure, Rockfon's costs would have been lower for numerous reasons detailed above, which would have made Rockfon's but-for incremental profit margins higher. Here, I conservatively focus on the but-for cost reduction that is the most quantifiable: the fact that without the anticompetitive foreclosure, Rockfon would have built and opened its domestic manufacturing plant earlier, which would have significantly reduced Rockfon's incremental costs of acquiring additional SACTs by saving it ocean freight costs.³⁸⁶ This means that I am for now conservatively putting aside other but-for cost reductions, such as greater economies of scale in the domestic facility, lower distribution costs, shorter lead times, and faster learning cost economies.³⁸⁷ However, I reserve the right to include those additional cost reductions if I can find a reliable way to quantify them.

253. Rockfon sales data shows that the difference in the cost of acquiring SACTs between the domestic plant and the Polish plant is due almost entirely to the cost of freighting the SACTs from Poland across the Atlantic Ocean. The Gross Transfer Price (which excludes Ocean Freight) for SACTs produced in Poland is on average within 1% of the Gross Transfer Price of those exact same

³⁸⁵ "ROXARM48 actual incremental cost as a pct of netsales.csv".

³⁸⁶ See Part IV.A.1 & VII.A.

³⁸⁷ See Part IV.A.2, IV.B-C, VII.B.

SACTs when produced in the United States (limiting the comparison to months in which the same model of SACT was produced in both the U.S. and Poland).³⁸⁸

254. The exact amount by which Rockfon's profit margins would have increased in the but-for world depends on when Rockfon's domestic manufacturing plant would have opened in the but-for world. As I show below in Part VII.A.4, the month in which Rockfon would have opened the domestic manufacturing plant in the but-for world depends on how quickly Rockfon's sales would have grown in the but-for world, which in turn depends on which conduct one assumes would have existed in the but-for world. I therefore calculate Rockfon's but-for profit margins separately for each of the four alternative assumptions about which conduct would exist in the but-for world. Table 26 below shows when Rockfon would have opened its domestic manufacturing plant under each of the four alternative assumptions about the but-for world (I explain precisely how these dates are calculated below in Part VII.A.4).

³⁸⁸ "ROXARM31 average Poland cost premium.csv". To be precise, the GTP for SACTs produced in Poland is on average 0.96% higher than the GTP of the same SACTs produced in the same month in the United States.

Table 26: When Rockfon's Domestic Manufacturing Plants Would Have Begun Production³⁸⁹	
Scenario	Month When Rockfon's Domestic Manufacturing Plant Would Have Begun Production
Actual world (with all the Armstrong and USG foreclosure)	July 2017
But-for Armstrong and USG foreclosure	August 2015
But-for Armstrong foreclosure	January 2016
But-for Armstrong or USG foreclosure, excluding Armstrong Minimum Purchase Requirements	September 2015
But-for Armstrong foreclosure, excluding Minimum Purchase Requirements	March 2016

255. To calculate Rockfon's but-for cost of acquiring SACTs, I calculate in each month how much of Rockfon's but-for U.S. sales would have been produced in Poland and how much would have been produced domestically. In each month, the total but-for acquisition costs each the actual average GTP/ft² in that month multiplied times total U.S. but-for ft² sold, plus the actual average ocean freight per square foot multiplied times the square feet of SACTs produced in Poland (for sale in the U.S.) in the but-for world. I then divide those total but-for U.S. acquisition costs by total but-for U.S. revenues to calculate the but-for acquisition cost as a percentage of net sales.

256. Table 27 shows Rockfon's cost of acquiring SACTs as a percentage of net sales in the actual world and under the four alternative but-for worlds. Rockfon's cost of acquiring SACTs is identical in the but-for and actual worlds for 2014 because the domestic manufacturing plant would not have been built by 2014 in any of the but-for worlds. In contrast, in later years Rockfon's but-for acquisition costs are lower than its actual acquisition costs (as a percentage of net sales) because Rockfon would have been producing more SACTs at its domestic

³⁸⁹ "ROXARM93 Rockfon FT2 Linear Predictions.csv".

plant in the but-for world and therefore would have been paying ocean freight for a smaller proportion of its SACT sales.

Table 27: Actual vs But-for Costs of Acquiring SACTs as a Percentage of Net Sales³⁹⁰						
Year	But-for the following foreclosing conduct...					
	None (Actual World)	Arm & USG Agreements	Arm Agreements Only	Arm & USG, Excluding Min Purchase	Arm Only, Excluding Min Purchase	
2014						
2015						
2016						
2017						
2018						

257. Warehouse costs and outbound freight costs as a percentage of net sales are the same in the actual world and but-for worlds. Table 28 below shows Rockfon’s incremental profit-margins in each of the four alternative but-for worlds.

³⁹⁰ “ROXARM93 but-for acquisition cost as p netsales.csv”. But-for acquisition costs are slightly higher in 2018 but for AWI-USG foreclosure than but for Armstrong-only foreclosure because but-for Rockfon sales without AWI-USG foreclosure in 2018 would have been so high that Rockfon would have had to import a larger proportion from Poland in that year despite the domestic plant. Likewise, across all categories, but-for acquisition costs are higher in 2018 than in 2017 because but-for Rockfon sales would have increased enough by 2018 that Rockfon would have needed to import more from Poland despite the domestic plant. My analysis here ignores the likelihood that in the but-for world Rockfon would have added a second production line to the domestic plant, *see* Part IV.B, because that likelihood reflects one of the but-for cost reductions (economies of scale in operating the domestic plant) that I have so far conservatively put aside for my damages analysis.

Table 28: Actual vs But-for Incremental Profit Margins³⁹¹					
Year	But-for the following foreclosing conduct...				
	None (Actual World)	Arm & USG Agreements	Arm Agreements Only	Arm & USG, Excluding Min Purchase	Arm Only, Excluding Min Purchase
2014					
2015					
2016					
2017					
2018					

C. Lost Profits

258. As described above, Rockfon's incremental profits in the actual world equal its actual revenue multiplied times Rockfon's actual incremental profit margin. Likewise, Rockfon's incremental profits in the but-for world equal its but-for revenue multiplied times Rockfon's but-for incremental profit margin. Table 29 below shows this incremental profit calculation for the actual world and but-for Armstrong and USG's foreclosing agreements.

Table 29: Incremental Profit Calculation Actual World vs. But-for Armstrong and USG Foreclosure³⁹²						
Year	Actual World			But-for Armstrong and USG Foreclosure		
	Revenue	Margin	Profits	Revenue	Margin	Profits
2014	\$		\$	\$		\$
2015	\$		\$	\$		\$
2016	\$		\$	\$		\$
2017	\$		\$	\$		\$
2018	\$		\$	\$		\$

259. Rockfon's lost profits equal its but-for incremental profits minus its actual incremental profits. (Because non-incremental costs are the same in the

³⁹¹ "ROXARM93 but-for profit margins.csv".

³⁹² "ROXARM93 Actual But for Profits Formula.csv".

actual and but-for world, they do not affect lost profits.) Table 30 below shows this calculation for lost profits due to Armstrong and USG's foreclosing agreements. It shows that Rockfon's total lost profits due to Armstrong and USG's foreclosing agreements from 2014-2018 are approximately \$25.1M.

Table 30: Lost Profit Calculation: But-for Armstrong and USG Foreclosure³⁹³			
Year	Profits in Actual World	Profits But-for Armstrong & USG Foreclosure	Lost Profits Due to Armstrong and USG Foreclosure
2014	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2015	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2016	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2017	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2018	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
Total	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]

260. Table 31 below shows Rockfon's lost profits under each of the four alternative but-for worlds. As discussed above, these figures are a highly conservative floor on Rockfon's true lost profits for many reasons, including that they ignore the fact that without the foreclosure Rockfon also would have sold better to unforcedclosed customers due to having shorter lead times, more access to the most efficient means of distribution, and greater demand within the U.S.

³⁹³ "ROXARM93 lost profit formula.csv".

Table 31: Conservative Floor on Rockfon's Damages from Foreclosing Agreements³⁹⁴				
Year	Damages from ...			
	All Armstrong and USG's Foreclosing Agreements	All Armstrong's Foreclosing Agreements	Armstrong and USG's Foreclosing Agreements Other than Min Purchase	Armstrong's Foreclosing Agreements Other than Min Purchase
2014	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2015	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2016	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2017	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2018	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]
2014-2018	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]	\$ [REDACTED]

VII. ROCKFON WOULD HAVE EXPANDED CAPACITY FASTER IN THE BUT-FOR WORLD TO KEEP UP WITH ITS FASTER GROWTH IN SALES

261. As shown in Part VI.A, the demand for Rockfon's SACTs in the United States would have grown significantly faster but for the anticompetitive foreclosure. I have therefore analyzed the evidence to check whether Rockfon would have had enough capacity to supply that extra demand and whether Rockfon would have had to make additional investments to expand capacity to meet that extra demand. Ultimately, the evidence shows that Rockfon could have supplied the greater but-for demand by simply making the same capacity-expanding investments it made in the actual world, but earlier. Rockfon followed the standard profit-maximizing strategy of not making additional capacity-expanding investments until its demand increased enough to require that additional capacity. Without the anticompetitive foreclosure, Rockfon's demand would have grown faster, so those capacity-expanding investments would have been required earlier, and Rockfon would thus have made those capacity-expanding investments earlier.

³⁹⁴ "ROXARM93 lost profits all 4.csv".

A. Rockfon Would Have Built Its Domestic SACT Manufacturing Plant Earlier in the But-for World

262. By slowing Rockfon’s growth in North America, the anticompetitive foreclosure delayed the date on which it became profit-maximizing for Rockfon to invest in Rockfon’s efficiency-increasing North American manufacturing plant. Given the actual market foreclosure, Rockfon did not start building the domestic manufacturing plant until March 2016 and did not complete it until July 2017.³⁹⁵ Had the market not been foreclosed, Rockfon would have decided to build the plant much earlier, as I show below.

1. Profit-maximizing Firms, Including Rockfon, Make Decisions About When to Invest in Expansions Based on Net Present Value

263. A capital expenditure, such as investing in a manufacturing plant, is profit-maximizing for a firm if it has a positive “net present value” (“NPV”) when using the firm’s cost of capital as the discount rate.³⁹⁶ The NPV of a capital expenditure is equal to the present value of the firm’s profits from that capital expenditure over time (including the initial expenditure).³⁹⁷ Mathematically, the NPV of an investment is:

$$NPV = \sum_{t=0}^{\infty} \frac{\Delta\pi_t}{(1+i)^t}$$

264. Where t equals the time period (ranging from 0 in the present to infinity), $\Delta\pi_t$ equals the firm profits with the investment minus the firm profits without the investment in time t , and i equals the firm’s cost of capital. A firm’s “cost of capital” is the cost of acquiring resources, which can then be used for investments projects – thus, it is the minimum return that a capital investment must earn to be worthwhile to the firm and its investors.³⁹⁸

³⁹⁵ See *supra* Part I.C.1.

³⁹⁶ Ronald W. Hilton, *Managerial Accounting* (9th Ed. 2011), p. 688 (“Compute the present value of each cash flow, using a discount rate that reflects the cost of acquiring investment capital. ... If the net present value (NPV) is equal to or greater than zero, accept the investment proposal. Otherwise, reject it.”).

³⁹⁷ See Ronald W. Hilton, *MANAGERIAL ACCOUNTING* (9TH ED. 2011), p. 795 (“net present value: The present value of a project’s future cash flows less the cost of the initial investment.”).

³⁹⁸ Ronald W. Hilton, *Managerial Accounting* (9th Ed. 2011), p. 791 (“cost of capital: The cost of acquiring resources for an organization, either through debt or through the issuance of stock.”)

265. As a simple example, suppose a firm has a cost of capital of 10% per year and making a \$110 investment in marketing the firm's product in the current year ($t=0$) would increase profits by \$60 in the next year ($t=1$) and the year after that ($t=2$), but would not affect profits in any later years. The NPV of this investment would equal:

$$\frac{-110}{(1+.10)^0} + \frac{60}{(1+.10)^1} + \frac{60}{(1+.10)^2} = -110 + 54.5 + 49.6 = -5.9$$

266. In this simple example, even though the cost of the investment (\$110) is less than the total increase in future profits (\$120), the net present value is negative after accounting for the fact that the future increase in profits must be discounted by the firm's cost of capital. Consequently, it would not be profit-maximizing for the firm to make this investment. Essentially, comparing the investment's return to the firm's cost of capital implies that the firm could obtain a better return on investment by investing that money differently.

2. Foreclosure That Slows Growth Delays the Date When Investing in a Domestic Manufacturing Plant Has Positive Net Present Value

267. Applying these NPV concepts to Rockfon's investment in a domestic manufacturing plant illustrates how foreclosure that slowed Rockfon's sales growth would delay when it becomes profit-maximizing to invest in the domestic plant (i.e., when the NPV of investing in the plant becomes positive). The cost of capital Rockfon used when evaluating the profitability of the domestic manufacturing plant was 11.4%.³⁹⁹ The evidence indicates that it cost Rockfon approximately \$[REDACTED] to build the manufacturing plant and that doing so took approximately one year.⁴⁰⁰ Consequently, $\Delta\pi_t$ equals negative \$[REDACTED] in year 0. Investing in the domestic manufacturing plant affects future profits in multiple ways, but to simplify this example slightly we will focus on two particular ways: (1) reducing incremental costs; and (2) increasing capacity.⁴⁰¹ The reduction in incremental costs increases the profit margin on every sale made in each time period, and the increase in capacity allows the firm to make additional sales, but only in time periods where the quantity demanded exceeds the firm's capacity without the investment in the manufacturing plant.

³⁹⁹ ROXUL_5571846, "NPV & PL EUR m2" tab, cell C60.

⁴⁰⁰ See *supra* Part I.C.

⁴⁰¹ As explained in Parts IV.A.2-3, investing in the domestic manufacturing plant also reduces lead times and increases demand for the product.

268. In this hypothetical, the initial capital investment is \$40. For simplicity, we will assume there are only three time periods: year 0, year 1, and year 2. Assume Rockfon's price is \$1/ft² in both the actual and but-for worlds.⁴⁰² Assume Rockfon's incremental cost without the domestic manufacturing plant is $c = \$0.50/\text{ft}^2$. With the domestic manufacturing plant, Rockfon would save on ocean freight costs from no longer having to import SACTs from Poland, reducing its incremental cost by $r = \$0.05/\text{ft}^2$, which would make its incremental cost with the domestic manufacturing plant $\$0.45/\text{ft}^2$.⁴⁰³ Similar to reality, assume the quantity demanded of Rockfon grows linearly over time, but that Rockfon's demand grows twice as fast if the market is not foreclosed by anticompetitive conduct. Define the quantities demanded if the market is foreclosed as q_{f0} , q_{f1} , and q_{f2} (in years 0, 1, and 2, respectively), with their values being 100, 200, and 300 ft². Define the quantities demanded if the market is unforced as q_{u0} , q_{u1} and q_{u2} with the values, 200, 400, and 600 ft². Finally, assume that the domestic manufacturing plant would expand Rockfon's capacity from 300 ft²/year to 1,000 ft²/year.

269. In this hypothetical, the values of $\Delta\pi_t$ in the NPV formula are as follows if the market is foreclosed (NPV_f). They reflect the fact that Rockfon would incur a \$40 investment cost in year 0 and would save \$0.05 on each sale in years 2 and 3 (due to the reduction in incremental costs). Because with foreclosure suppressing demand, Rockfon has enough capacity to supply that demand without the domestic manufacturing plant, the additional capacity the manufacturing plant provides does not change Rockfon's profits when the market is foreclosed.

$$\Delta\pi_{0f} = -40$$

$$\Delta\pi_{1f} = 200(0.05) = 10$$

$$\Delta\pi_{2f} = 300(0.05) = 15$$

The NPV of the domestic manufacturing plant in year 0 if the market is foreclosed is therefore *negative* \$18.9 (indicating the investment would not be profit-maximizing at that time), as the formula below shows.

⁴⁰² This is a simplifying assumption: in the but-for world Rockfon would have lower incremental costs causing it to have lower prices, higher quantities, and overall higher profits.

⁴⁰³ This assumption is similar to reality, where savings on ocean freight costs would result in an overall reduction in Rockfon's incremental cost per unit. *See supra* Part IV.A.1.

$$NPV_f = \frac{-40}{(1+.114)^0} + \frac{10}{(1+.114)^1} + \frac{15}{(1+.114)^2} = -40 + 9.0 + 12.1 = -18.9$$

270. In contrast, if the market were unforced, then the values of $\Delta\pi_t$ would be significantly higher in years 1 and 2, because without foreclosure the faster growth in demand would mean that the domestic manufacturing plant's additional capacity would allow Rockfon to make more sales with the domestic manufacturing plant than without. Specifically, if the market were unforced, then, in this hypothetical, Rockfon would be able to sell 100 ft² more with the domestic manufacturing plant than without in year 1 (because the 400 ft² demanded in year 1 would exceed the capacity without the domestic manufacturing plant by 100ft²), and 300 ft² more with the domestic manufacturing plant than without in year 2 (because the 600 ft² demanded in year 2 would exceed the capacity without the domestic manufacturing plant by 300ft²).

$$\Delta\pi_{0u} = -40$$

$$\Delta\pi_{1u} = 300(0.05) + 100(1-0.45) = 70$$

$$\Delta\pi_{2u} = 300(0.05) + 300(1-0.45) = 180$$

The NPV of the domestic manufacturing plant in year 0 if the market were unforced (NPV_u) would therefore be *positive* 155.8 (indicating the investment *would* be profit-maximizing at that time), as the formula below shows:

$$NPV_{au} = \frac{-40}{(1+.14)^0} + \frac{70}{(1+.14)^1} + \frac{165}{(1+.14)^2} = -40 + 62.8 + 145.0 = 167.9$$

271. Thus, even though the incremental cost reduction of the manufacturing plant is the same regardless of whether the market is forced, the NPV of building a manufacturing plant is positive (profit-maximizing) if the market is unforced but negative (not profit-maximizing) if the market is forced. The manufacturing plant has a positive NPV if the market is unforced but not if the market is forced because the domestic manufacturing plant's additional capacity is necessary to satisfy expected demand in the but-for world but not in the actual world. More generally, unless the reduction in incremental costs is very large in comparison to the initial investment cost, investing in a manufacturing plant is unlikely to have a positive NPV until the firm needs the additional capacity from the manufacturing plant to satisfy demand.

Because Rockfon's demand would grow faster in the but-for world, it would reach the point when the additional capacity of the domestic manufacturing plant was necessary faster in the but-for world, and therefore building the domestic manufacturing plant would become a profitable investment (positive NPV) earlier in the but-for world.

3. Rockfon Based Its Actual Decision About When to Build Its Domestic Manufacturing Plant on the NPV Given That Market Was Foreclosed.

272. Internal Rockwool and Rockfon documents confirm that they based their decision on when to build the domestic manufacturing plant on the net present value of the investment, given that the North American market was foreclosed and the quantity of Rockfon SACTs demanded was therefore artificially depressed. For example, an internal presentation from August 2015 calculated the net present value of building the manufacturing plant so that it would be ready to produce SACTs in 2017.⁴⁰⁴ This presentation explicitly acknowledges that the North American market was foreclosed, stating "Virtually all distributors carry a single brand of ceilings and competitors are doing all they can to block us."⁴⁰⁵ This presentation's projections of Rockfon's growth in demand in North America reflected this foreclosure: it predicted that Rockfon would not reach a 5% share of the North American market until 2021,⁴⁰⁶ which matched the pace at which Rockfon was actually growing with the foreclosure, whereas my analysis indicates that Rockfon would have achieved a 5% share of the market by 2019 without the foreclosure.⁴⁰⁷ Thus, if the North American SACT market were not foreclosed, these same NPV formulas that Rockfon used to determine when to build the domestic manufacturing plant would have indicated that the domestic manufacturing plant had a positive NPV earlier than it did in the actual world where the market was foreclosed. Consequently, Rockfon would have built the domestic manufacturing plant earlier and therefore benefited from the increases in efficiency it provides earlier.

⁴⁰⁴ ROXUL_0105650 at ROXUL_0105653 (NPV calculation summary); *id.* at ROXUL_0105655 (showing that it assumes domestic manufacturing plant, which Rockfon referred to as the "Apollo" project, was necessary to keep pace with growth in the actual world at some point in 2017); *id.* at ROXUL_0105654 (chart illustrating that Rockfon is assuming that all SACTs would be imported in 2016 but produced domestically in 2017 under this NPV calculation).

⁴⁰⁵ ROXUL_0105650 at ROXUL_0105652.

⁴⁰⁶ ROXUL_0105650 at ROXUL_0105652.

⁴⁰⁷ *See supra* Part III.D.

273. This conclusion is consistent with the deposition testimony of Rockfon's President, John Medio. Mr. Medio testified that Rockfon started considering when to build a domestic manufacturing plant as soon as they started selling SACTs in North America.⁴⁰⁸ He explained that Rockfon decided not to build the plant immediately because "[g]enerally economically it doesn't make sense to have a factory that's not fully utilized from day one when you can do it in other ways that are efficient" and that what "Rockfon was waiting for to justify building of a domestic plant" was "[e]nough volume moving out of that plant to make it economically justifiable."⁴⁰⁹ This is consistent with my economic analysis above, showing that capacity-expanding investments typically will not be worthwhile investments until demand has increased enough to require the additional capacity.

4. In the But-for World, Rockfon Would Have Expanded Capacity by Building Its Domestic Manufacturing Plant Whenever North American Demand Necessitated It, Just As Rockfon Did in the Actual World

274. The NPV analysis above shows that the faster Rockfon's sales in North America would have grown absent the foreclosure, the earlier Rockfon would have built the domestic manufacturing plant. Therefore, the exact date on which Rockfon would have opened the domestic manufacturing plant in the but-for world depends on how quickly Rockfon's North American sales would have grown in the but-for world. As I show in Part VI.A, the speed of Rockfon's sales growth in the but-for world depends on what conduct would not exist in the but-for world,

⁴⁰⁸ John Medio (Rockfon President) 30(b)(6) at 51:8-52:11 ("Q. Right. But if you intend to sell the product and you think there's a benefit to selling it domestically, my question is did you ever consider building first and then starting your sales? A. Oh, in that sense, yes, in the sense that once we have decided to sell product in the United States, did we consider building a factory, yes.").

⁴⁰⁹ John Medio (Rockfon President) 30(b)(6) at 51:8-52:11 ("Q. Right. But if you intend to sell the product and you think there's a benefit to selling it domestically, my question is did you ever consider building first and then starting your sales? A. Oh, in that sense, yes, in the sense that once we have decided to sell product in the United States, did we consider building a factory, yes. Q. [...] Did you ever consider having decided that you were going to sell ceiling tile in the United States building the plant first before you set up shop to sell the tile? A. Yes, it's always a consideration. But as I mentioned, we run a business. So planned capacity is important, the cost of supplying that is important. Generally economically it doesn't make sense to have a factory that's not fully utilized from day one when you can do it in other ways that are efficient." Q. And so what was it that Rockfon was waiting for to justify the building of a domestic plant? A. Enough volume moving out of that plant to make it economically justifiable.").

and therefore the exact date that the domestic manufacturing plant would open also depends on which conduct one assumes would exist in the but-for world.

275. Ultimately, the evidence indicates that in the actual world Rockfon simply decided to start expanding capacity whenever its sales forecasts indicated that doing so would be necessary to meet demand. It tailored capacity increases to expected increases in demand, and incremental demand had to meet a certain volume threshold to make capacity expansions economically justifiable: “[w]e don’t want to build a plant before it’s absolutely necessary to build.”⁴¹⁰ For instance, in the actual world, Rockfon considered an option whereby it would build a plant in both Mississippi and Ontario, but rejected that option because “what we saw is the constraints in the market and where our ability to grow was” and “we felt that one line in Mississippi could adequately service what we needed.”⁴¹¹ Thus, in the actual world, Rockfon sought to maximize its profits given the reality of the anticompetitive foreclosure, which included not expanding capacity as rapidly as it otherwise could have done.

276. Likewise, in the but-for world Rockfon would simply decide to expand capacity whenever its (much higher) sales forecasts would have indicated that doing so would be necessary to meet demand. In the actual world, Rockfon began producing SACTs at its domestic manufacturing plant in July 2017,⁴¹² at which point Rockfon was selling SACTs at a pace of roughly [REDACTED] million square feet per month in North America.⁴¹³ One would therefore likewise expect that

⁴¹⁰ See John Medio (Rockfon President) 30(b)(6) Dep. at 61:7-21 (“Q. What are the uncertain factors in the analysis currently? A. Demand, ceiling tile demand. Available capacity, right. We’re talking about planned capacity, right. **We don’t want to build a plant before it’s absolutely necessary to build. So if tomorrow we find a way to get more capacity out of our existing plant, we would probably delay the investment of a new plant. Likewise, if tomorrow we see a change in demand for ceiling tiles, we’d want to accelerate the production of a new plant.** So it’s not unreasonable to say that variables change constantly, and we do our best to assess it at any given point in time.” [emphasis added]).

⁴¹¹ John Medio (Rockfon President) 30(b)(6) Dep. at 32:16-33:3.

⁴¹² AWI00013662 (Jul. 14, 2017 internal Armstrong email, copying a Rockfon press release announcing that “Production started today at Rockfon’s first North America manufacturing facility in Marshall County, Mississippi.”)

⁴¹³ “ROXARM93 Rockfon FT2 Linear Predictions.csv”. To account for seasonal variation in SACT demand, I calculate the rate at which Rockfon was selling SACTs in any given month based on a linear prediction of Rockfon’s square feet sales in any given month. I calculate this linear prediction using the regression $ft2_sold = b_0 + b_1 * months_since_Oct2013$, where the dependent variable equals the square feet sold in North America, and the independent variable equals the number of months since October 2013. Note that I assume that Rockfon’s

Rockfon would have begun producing SACTs at its domestic manufacturing plant in the but-for world whenever it reached a pace of selling [REDACTED] million square feet per month in the but-for world.⁴¹⁴

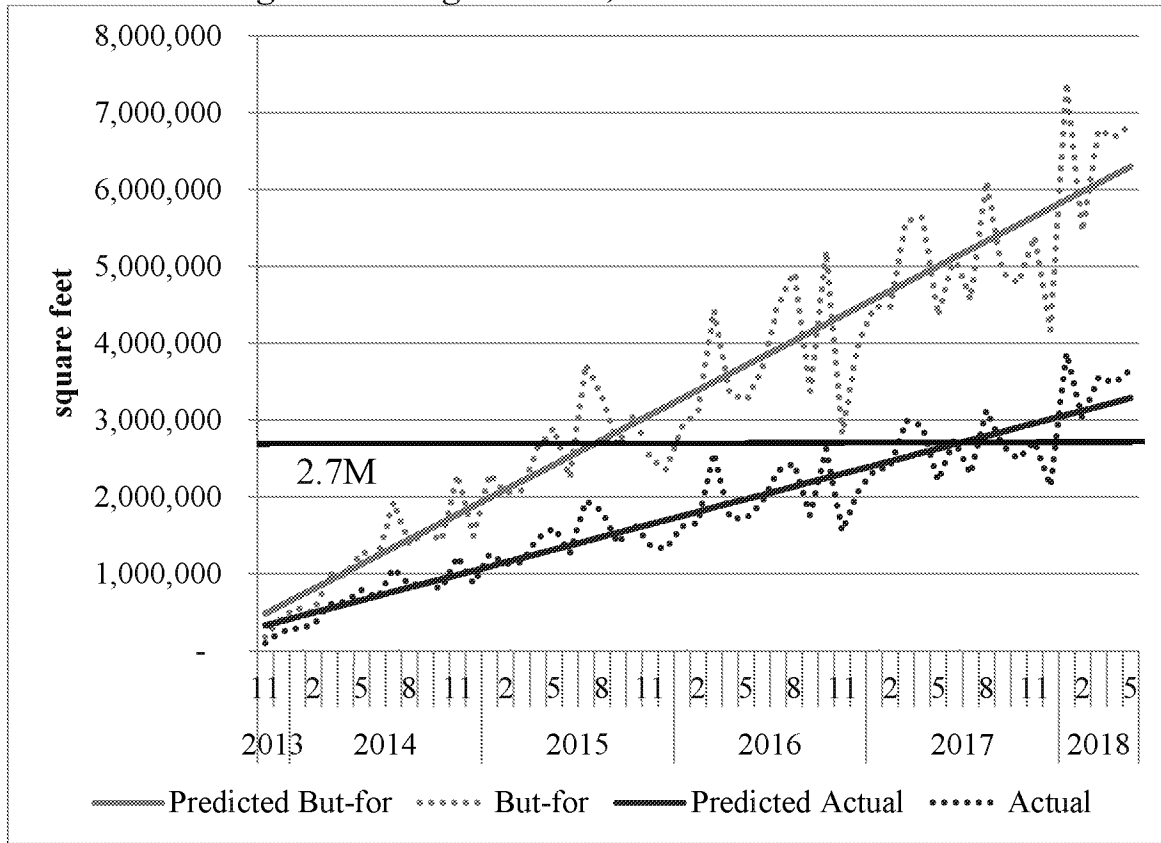
277. The answer depends on which of the foreclosing agreements would not have existed in the but-for world. For example, but-for Armstrong and USG's foreclosing agreements, Rockfon would have been selling [REDACTED] million square feet per month much earlier, by August 2015,⁴¹⁵ which indicates that Rockfon would have begun production at its domestic manufacturing plant in August 2015 but-for Armstrong and USG's foreclosing conduct. Figure 26 below illustrates this: the dotted lines show the exact actual and but-for square feet estimate in each month, and the solid lines show linear predictions of actual and but-for square feet (the linear predictions provide the best estimate of the pace of Rockfon's sales growth in any given month because it is less affected by seasonality). One can see that Rockfon's sales would have reached [REDACTED] square feet per month (the black horizontal line) by August 2015 but-for Armstrong and USG's foreclosing agreements, but did not reach that pace in the actual world (with the foreclosure) until July 2017.

sales in Canada are identical in the actual and but-for worlds, given the Court's ruling that it lacks jurisdiction over Canada.

⁴¹⁴ Given that Rockfon cannot build the plant instantaneously, this would require Rockfon to accurately project when its sales would reach a pace of 2.7 million square feet per month in the but-for world. The evidence indicates that Rockfon's actual decision of when to build the plant was based on an accurate prediction of its 2017 sales. The 2015 spreadsheet showing the predicted future sales Rockfon used when calculating the NPV of the domestic manufacturing plant predicted that Rockfon would sell [REDACTED] square feet in 2017. ROXUL_5571846, "NPV & PL" tab, cell D5. Rockfon actually sold [REDACTED] square feet in 2017, "ROXARM93 actual vs butfor ft2 monthly.csv", so Rockfon's prediction of its 2017 sales was within 1% of its actual 2017 sales. Rockfon's accuracy at predicting its future sales based on its actual sales is not surprising given that Rockfon's sales grew at a steady linear pace in the actual world, as seen below in Figure 26. Rockfon would likewise be able to accurately predict its future sales in the but-for world, because its sales would also increase at a consistent linear pace in the but-for world, just faster than they did in the actual world. See Figure 26 below.

⁴¹⁵ "ROXARM93 Rockfon FT2 Linear Predictions.csv".

Figure 26: Actual Rockfon North American Sales versus Sales But-for Armstrong or USG Agreements, based on Linear Prediction⁴¹⁶



278. Table 32 below shows when Rockfon’s domestic manufacturing plant would have begun production under each of the four alternative assumptions about which foreclosing agreements would not have existed in the but-for world. As described above, the month when Rockfon would have begun production at its domestic manufacturing plant in the but-for world is whatever month at which Rockfon’s but-for North American sales would have reached a rate of [REDACTED] square feet per month.

⁴¹⁶ “ROXARM93 predicted actual and but-for monthly sales.csv”.

Table 32: When Rockfon’s Domestic Manufacturing Plants Would Have Begun Production⁴¹⁷	
Scenario	Month When Rockfon’s Domestic Manufacturing Plant Would Have Begun Production
Actual world (with all the Armstrong and USG foreclosure)	July 2017
But-for Armstrong and USG foreclosure	August 2015
But-for Armstrong foreclosure	January 2016
But-for Armstrong or USG foreclosure, excluding Armstrong Minimum Purchase Requirements	September 2015
But-for Armstrong foreclosure, excluding Minimum Purchase Requirements	March 2016

5. Domestic Manufacturing Plant Had Enough Capacity to Supply the Lion’s Share of Rockfon’s But-for U.S. Demand on Its Own

279. Rockfon’s domestic manufacturing plant in Mississippi alone has the ability to produce [REDACTED] million square feet per year.⁴¹⁸ By comparison, the maximum square feet of SACTs Rockfon North America would have sold in any year in the but-for world was [REDACTED] million (in 2018, assuming that neither the Armstrong nor USG foreclosing agreements existed in the but-for world).⁴¹⁹ Thus, even if we put aside the likelihood that in the but-for world Rockfon would have

⁴¹⁷ “ROXARM93 Rockfon FT2 Linear Predictions.csv”.

⁴¹⁸ ROXUL_3920079 (March 2017 email in which John Medio says that, “per the approved plan [...] Total Capacity [REDACTED] MM m2 (w/o 2nd ring it’s [REDACTED] m2)” but that “The capacity is expected to be closer to [REDACTED] MM m2 due to mix.”). [REDACTED] million meters squared is equivalent to [REDACTED] million square feet.

⁴¹⁹ “ROXARM93 but-for annual Rockfon North American ft2.csv”

added a second production line to its domestic plant,⁴²⁰ the domestic plant alone has enough capacity to supply the lion's share of Rockfon's but-for demand. The at most [REDACTED] million ft² difference between Rockfon's maximum but-for annual demand and the Mississippi plant's maximum production in 2018 could easily be supplied by Rockwool's Polish manufacturing plant, from which Rockfon imported [REDACTED] million square feet of SACTs in 2017.⁴²¹

B. Rockwool Had Sufficient Production Capacity in Poland to Satisfy the Additional Demand in the But-for World Until the Domestic Manufacturing Plant Opened

280. Rockfon's President testified that they started considering when to build a domestic manufacturing plant as soon as they started selling SACTs in North America.⁴²² However, even if Rockfon had decided to start building its domestic manufacturing plant immediately after it purchased CMC in October 2013, it would have taken about 21 months before the plant began production (about 5 months of planning and 16 months of building the plant).⁴²³ Further, learning curve economies meant that the plant would not start with its ultimate production capacity, but rather would steadily ramp up to its ultimate production

⁴²⁰ See *supra* Part IV.B.

⁴²¹ "ROXARM31 Polish and US Output by year.csv". This data shows that Rockfon North America sold 30.8 million square feet of SACTs imported from Poland in 2017.

⁴²² John Medio (Rockfon President) 30(b)(6) at 51:8-52:11 ("Q. Right. But if you intend to sell the product and you think there's a benefit to selling it domestically, my question is did you ever consider building first and then starting your sales? A. Oh, in that sense, yes, in the sense that once we have decided to sell product in the United States, did we consider building a factory, yes.").

⁴²³ In the actual world Rockwool's board approved the investment in the domestic manufacturing plant in November 2015. ROXUL_0515886 (November 19, 2015 email sent by John Medio stating "we have confirmed plans to build our first North American manufacturing facility in the U.S. . . . Construction will begin in early 2016, with production expected to begin mid-2017."). Construction started about 5 months later in March 2016. ROXUL_0432098 (Jan. 21, 2016 email stating that "He [Mississippi Governor Bryant] will also attend the official ground breaking for Apollo at MAR on March 16th (afternoon)."). Production began about another 16 months later on July 14, 2017. AWI00013662 (Jul. 14, 2017 internal Armstrong email, copying a Rockfon press release announcing that "Production started today at Rockfon's first North America manufacturing facility in Marshall County, Mississippi."). Although Rockfon's President testified that they might have been able to plan and build the plant faster if there were greater urgency, Medio 30(b)(6) Deposition at 29, here I conservatively assume that it would have taken the same amount of time to plan and build the plant in the but-for world as it did in the actual world.

capacity of [REDACTED] million ft² per year⁴²⁴ over the course of 18 months.⁴²⁵ A steady linear increase would imply that the domestic manufacturing plant's annual production capacity would increase by [REDACTED] ft² each month.⁴²⁶ Thus, in the but-for world the domestic manufacturing plant would have opened no earlier than July 2015 (21 months after Rockwool bought CMC in October 2013) and would not have reached maximum capacity until January 2017 (18 months after July 2015).

281. Given that the domestic manufacturing plant would take about 21 months to build and another 18 months to reach its ultimate maximum capacity, I calculated how much of the additional but-for demand Rockfon would have needed to acquire from Poland in the but-for world. The additional amount of production Rockfon would have needed from Poland would have been highest if neither Armstrong's nor USG's foreclosing agreements existed in the but-for world. In such a but-for world, Rockfon would have opened its domestic manufacturing plant in August 2015, as explained above in Part A.4. Therefore, but-for Armstrong and USG's foreclosure, Rockfon's domestic production capacity would have started at [REDACTED] ft² per month in August 2015 and increased by [REDACTED] ft² per month for the next 17 months afterward.

282. Figure 27 below shows Rockfon's domestic capacity, domestic production, and Polish production in each month but-for Armstrong and USG's foreclosure. One can see that, because Rockfon would not start domestically producing SACTs until August 2015 but-for Armstrong and USG's foreclosure, Rockfon would have no domestic production capacity from October 2013 to July 2015, and therefore would have to produce all of the SACTs it sold during that

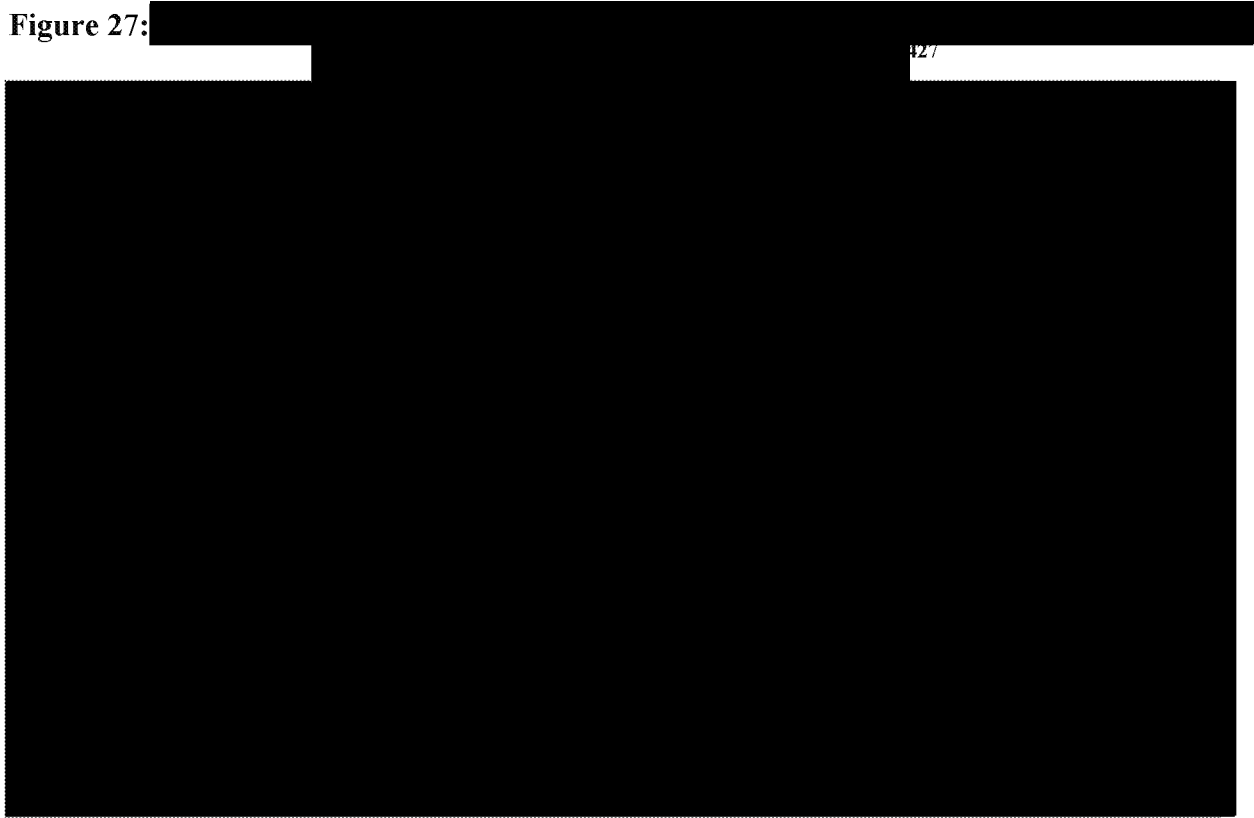
⁴²⁴ ROXUL_3920079 (March 2017 email in which John Medio says that, "per the approved plan [...] Total Capacity [REDACTED] MM m2 (w/o 2nd ring it's [REDACTED] MM m2)" but that "The capacity is expected to be closer to [REDACTED] MM m2 due to mix."). [REDACTED] million meters squared is equivalent to [REDACTED] million square feet.

⁴²⁵ ROXUL_0093373 (slide showing a learning curve extending from mid-2017 through the end of 2018); ROXUL_5535499 (June 2016 presentation) at ROXUL_5535510 (again showing a learning curve from mid-2017 through the end of 2018); Prabodh Kadkol (Rockfon VP of Operations) Dep. at 96:5-11 ("Q. You used the term "learning curve" several times. What do you mean by that? A. Essentially just means the process of learning the products and how you ramp up. It's a ramp-up plan -- Q. Okay. A. -- in different words."). Note that Rockfon had previously predicted that the domestic manufacturing plant would be able to meet its ultimate capacity in only 12 months. ROXUL_4836803 at ROXUL_4836825. It therefore may be conservative to assume that it would instead take 18 months for Rockfon's domestic manufacturing plant to ramp up to its ultimate capacity.

⁴²⁶ This implies that the domestic manufacturing plant's monthly production capacity would increase by [REDACTED] M ft² per month.


period in Poland. However, once Rockfon would have opened the domestic plant in August 2015, its domestic capacity would have steadily increased each month, allowing Rockfon to wean itself off of Polish production.


Figure 27:






283. Table 33 below shows the total amount of square feet of SACTs Rockfon North America would have had to import from Poland in each year but-for Armstrong and USG's foreclosure. One can see that the most Rockfon would have had to import from Poland in any given year was [REDACTED] M ft² in 2015.

⁴²⁷ "ROXARM93 monthly capacity and production but-for awiorusg".

Table 33: Square Feet of SACTs Rockfon North America Would Have Had to Import from Poland But-for Armstrong and USG’s Foreclosure ⁴²⁸			
Year		ft ²	
2013			
2014			
2015			
2016			
2017			

284. The evidence indicates that Rockfon and Rockwool had more than sufficient capacity in Europe to produce the additional Rockfon SACTs demanded in the U.S. in the but-for world until the domestic manufacturing plant was built and had reached maximum capacity. For example, Rockfon actually imported 24.0 million ft² of SACTs from Poland in 2016, and imported  million ft² of SACTs in 2017,⁴²⁹ meaning that Rockfon's actual annual imports from Poland in 2017 exceeded the maximum amount Rockfon would need to import from Poland in any given year in the but-for world.

285. Further, the evidence indicates that Rockwool could significantly expand its production of Rockwool tiles even before the U.S. plant opened. Rockwool's global production of Rockfon SACTs increased from  million ft² in 2014 to  million ft² in 2016,⁴³⁰ indicating that Rockwool had the ability to increase its annual production by at least  million ft² per year even before Rockfon opened the domestic manufacturing plant in Mississippi. Rockwool used a variety of methods to expand production at the Polish facility. Rockfon President John Medio explained that this could be achieved by "debottlenecking," which is "adding shifts," and by "plann[ing] differently" and "tak[ing] advantage of seasonal swings to build inventory to service the market."⁴³¹ He similarly noted

⁴²⁸ "ROXARM93 Polish Production NA but-for AwiOrUSG.csv".

⁴²⁹ "ROXARM31 Polish and US output by year.csv".

⁴³⁰ "ROXUL_555856 at ROXUL_555891.xlsx." ROXUL_555856 at ROXUL_555891 indicates the absolute growth in millions of meters squared of Rockfon tile sales in each year from 2015 to 2017 and the percentage growth over the previous year sales that that absolute growth represents. One can therefore calculate the actual sales in the previous year by dividing the growth figure in meters squared by the percentage of the previous year's sales.

⁴³¹ John Medio (Rockfon President) 30(b)(6) Dep. at 46:3-19 ("Q. And you've stayed ahead of that by building additional lines or by doing something else? [...] A. I would say doing something else, right. So adding shifts, as I call it debottlenecking, which is essentially when we do an exercise to figure out how much extra capacity we can get out of it. We've planned

they have “done the debottlenecking” to expand the capacity of two of the lines at the Polish facility (one by █%), and have also “shifted mix of products.”⁴³² They have also “expanded the line” by adding additional functionalities to one of the lines.⁴³³ Rockfon VP of Operations Prabodh Kadkol similarly explained that “capacity of the Polish plant increased over time” as a result of “[i]mprovements to the line, improvements to the process, some automation projects, so many different things”.⁴³⁴ He also noted the possibility of “rebalancing of the overall capacity” among different Rockfon facilities to supply Rockfon North America.⁴³⁵ Such efforts could have been undertaken earlier in the but-for world to meet increased U.S. demand for Rockfon SACTs until the Marshall plant could be completed.

differently. We've taken advantage of seasonal swings to build inventory to service the market. So we've done a lot of things.”).

⁴³² John Medio (Rockfon President) 30(b)(6) Dep. at 75:15-76:10 (“[...]A. No. I think, you know, as I said, these things change all the time. Back when we did this exercise, that was the estimate at the time based on what we knew. But even since then, we've done the debottlenecking in Chancza, which expanded the capacity of the Gjall line by 15 percent and improved the Cito line capacity. We've shifted mix of products. [...]”).

“Gjall” and “Cito” are both lines at the Polish facility. *See* Prabodh Kadkol (Rockfon VP of Operations) Dep. at 56:2-7 (“Q. So there's three lines in Poland? A. Correct. Q. And can you go through them? A. One is Gjall, as you were calling it. The second one would be Cito, and the third one is called Panel.”).

⁴³³ John Medio (Rockfon President) 30(b)(6) Dep. at 46:20-23 (“A. [...] And then in addition to that, we've expanded the line. So we added additional what we call a ring on the Cito line in Poland, we added a different type of painting cabin [...]”).

⁴³⁴ Prabodh Kadkol (Rockfon VP of Operations) Dep. at 62:14-63:5 (“Q. Has the capacity of the Polish plant increased over time? A. The capacity has increased, yes. [...] Q. What are the things that caused the capability to increase? A. Improvements to the line, improvement to the process, some automation projects, so many different things [...]”).

⁴³⁵ Prabodh Kadkol (Rockfon VP of Operations) Dep. at 170:23-171:13 (“Q. What other factories in Europe could Rockfon have opened up capacity in order to supply Rockfon North America? A. Potentially in Netherlands. Potentially in France as well as Russia. Q. Were there ever discussions about opening up capacity in France, Netherlands, or Russia in order to supply the North American -- Rockfon North America? A. Before this time, I'm not aware. After that, we have talked about different options because we look at global capacity, and different countries can be supplied from different plants. So really just a rebalancing of the overall capacity.”).

C. Documents That Armstrong Purports to Show Rockfon Capacity Constraints Actually Indicate Standard Profit-Maximizing Production and Capacity Planning

286. I have seen Armstrong counsel present Rockfon employees with documents that Armstrong purports show that Rockfon had capacity constraints that would have prevented it from selling more SACTs than Rockfon actually sold. However, economic analysis of the evidence indicates that these documents actually indicate that: (1) Rockfon engages in the standard profit-maximizing strategy of waiting to expand capacity until demand grows enough to justify it (discussed above) and: (2) Rockfon orders optimal amounts of production based on sales forecasts, which will occasionally result in sporadic shortages of particular products, much like how grocery stores occasionally run out of milk or airlines sometimes oversell their planes. I discuss this evidence below.

1. Evidence That Rockfon Waited to Expand Capacity Until Demand Justified It

287. Many of the capacity documents that Armstrong counsel questioned Rockfon employees about were planning documents illustrating that Rockfon follows the standard profit-maximizing practice of waiting to expand capacity until demand necessitates it. As described above in Part A, profit-maximizing firms make investment decisions based on the net present value of those investments, and the net present value of capacity-increasing investments generally will not be positive until the additional capacity is actually necessary. That is exactly what Rockfon did here.

288. For example, Armstrong counsel questioned Rockfon's VP of Operations, Prabodh Kadkol, about an internal Rockfon document from May 2015.⁴³⁶ This internal Rockfon document presented an argument that Rockwool should invest in a SACT manufacturing plant in the United States that can open by April 2017 in part because it projected that "worldwide Rockfon capacity will be exhausted by April 2017."⁴³⁷ From an economic perspective, this document reflects Rockfon engaging in exactly the sort of profit-maximizing net present value analysis that one would expect a firm to engage in. Indeed, in this document

⁴³⁶ Kadkol Deposition at 167-171. There counsel presents Mr. Kadkol with Exhibit 26 to that deposition, which is ROXUL_4487337.

⁴³⁷ ROXUL_4487337 ("The successful growth of ROCKFON in North America requires investment in local production for three primary reasons: 1. Worldwide ROCKFON capacity will be exhausted by April 2017"); *id.* at ROXUL_4487342 (proposing that they work on building the manufacturing plant in 2016 so that it is running by April 2017).

Rockfon calculates the net present value of the investment in order to determine whether it is profit-maximizing,⁴³⁸ just like economics textbooks state that firms should. Moreover, the document shows that Rockfon projected its future North American sales based on how its North American sales had grown so far in the actual world (with the foreclosure),⁴³⁹ which explains why this Rockfon document did not predict that the North American plant would be necessary until April 2017. In contrast, in the but-for world Rockfon's North American sales would have grown significantly faster, which would have increased Rockfon's projections of future sales and therefore resulted in Rockfon concluding that the North American manufacturing plant was necessary earlier.

2. Evidence That Rockfon Only Ordered the Production Of As Much As It Expected to Sell

289. Armstrong counsel also presented Rockfon employees with some documents indicating that Rockfon occasionally came close to running out of particular products in its warehouse. For example, Rockfon VP of Operations Prabodh Kadkol was asked about an August 2017 presentation stating that at the Polish facility "capacity is an issue for 2017 and getting worse by the day until Apollo [the Marshall, Mississippi facility] is fully up and running."⁴⁴⁰ In response, Mr. Kadkol testified that "I think we had overall anticipated that in 2017, the capacity could be constrained until the Apollo line is up and running."⁴⁴¹ Mr. Kadkol had separately testified that while "I'm sure there were sporadic events where we were constrained," that it was not an issue on a "consistent basis."⁴⁴²

⁴³⁸ ROXUL_4487337 (calculating that this proposed investment has an internal rate of return of [REDACTED]%, based on initial costs of [REDACTED] million euros and annual increases in profits of 19.4 million euros due to the fact that it provides the capacity necessary to Rockfon's sales to continue growing in North America).

⁴³⁹ ROXUL_4487337 at ROXUL_4487339-40.

⁴⁴⁰ ROXUL_4829287 (labeled with "RI BoD Meeting" "21-22 August 2017") at ROXUL_4829288. Introduced as Kadkol Exhibit 22.

⁴⁴¹ Prabodh Kadkol Dep. at 152:12-153:2 ("Q. Under Actions -- do you see Actions in the bottom right-hand corner? The second bullet under Actions reads: CIG capacity is an issue for 2017 and getting worse by the day until Apollo is fully up and running. Do you see that? A. Correct. Q. Is it your recollection that CIG capacity was an issue for 2017 and was getting worse by the day up until Apollo was up and running? A. Yeah, I think we had overall anticipated that in 2017, the capacity could be constrained until the Apollo line is up and running.").

⁴⁴² See Prabodh Kadkol (Roxul VP of Operations) Dep. at 63:21-64:5 ("Between May of 2015 when you joined the company and, let's say, the third quarter of 2017, were you aware of any time when Rockwool wasn't able to manufacture enough ceiling tile in Europe to meet the demand for ceiling tiles in Europe and the U.S.? A. I'm sure there were sporadic events where

This was an example of such a “sporadic event.” The evidence indicates that Rockfon’s sporadic shortages were merely the sort of common short-term logistical issues that essentially all manufacturers—including Armstrong—occasionally have.

290. Consistent with standard profit-maximizing strategy, Rockfon forecasts the quantity of its product that customers will demand in each future time period, and then only orders the production of as much tile as it expects to sell.⁴⁴³ In other words, at any given point in time Rockfon was only ordering the production of as much tile as it expected to need, given the foreclosure it faced, rather than the maximum amount of tile that it could possibly produce.⁴⁴⁴ This strategy of only ordering the production of what Rockfon expected to need is standard and profit-maximizing because ordering excessive amounts of production inefficiently increases warehousing costs (for storage of the extra tiles that are not being sold) and unnecessarily requires the company to incur the expenses of producing the excess SACTs earlier. In other words, there are error costs to both ordering excess production (higher costs, literally) and to ordering insufficient production (potentially longer lead times if a customer places an unexpectedly large order). The optimal amount of production to order is the amount that minimizes the sum of the expected error costs of over-ordering and under-ordering. Because it is impossible to forecast future sales with 100% accuracy, even firms that carefully try to determine the optimal amount of production will inevitably

we were constrained. But on a consistent basis, no.”) *and* at 66:16-20 (“Q. Do you recall any instances in which Rockfon experienced tile shortage capacity issues at its Baltimore warehouse?

A. Again, yes. Sporadically here and there, but not on a consistent basis.”).

⁴⁴³ See, e.g. Kahler (Rockwool) Deposition at 136 (explaining that Rockwool determines how much of the output of its manufacturing lines to allocate to tiles destined for North America based on the “forecast” of the volume demanded); *id.* at 137-138 (“it’s important to forecast the volumes . . . so they can optimize their sales”); *id.* at 184 (“Q: So it is your recollection that every allocation that Rockfon North America asked for from the Polish factory was given to them? A: And more – so the forecasted volumes have definitely been shipped.”). Kadkol (Rockfon VP of Operations) Deposition at 22 (“Q: . . . As VP for operations of Rockfon, are you responsible for ensuring sufficient tile is supplied by the Mississippi plant? A: Yes. Q: And how do you go about doing that? A: We . . . look at our forecasted sales, our inventory plan, and work with them to produce – plan and produce the product as needed.”); Medio (Rockfon 30(b)(6)) Deposition at 27 (“A: . . . As a business, you want to utilize your capacity as efficiently as possible. So on a day-to-day, week-to-week basis, you plan a certain amount of production based on expected demand.”).

⁴⁴⁴ Medio (Rockfon 30(b)(6)) Deposition at 27 (“any production facility has what we call actual capacity and planned capacity, right, actual capacity being the output of the entire factory running 24/7 and perfect quality by robots that do it perfectly.”).

overproduce slightly in some periods (resulting in excess warehousing costs) and underproduce in other periods (resulting in increased lead times).

291. These short-term logistical issues are hardly unique to Rockfon; indeed, Armstrong has similarly encountered short-term shortages due to similar logistical issues. For example, in a May 5-6, 2016 email chain about an “Armstrong Delivery Shortage,” an employee explains that more of a particular Armstrong SACT is “needed,” and another employee states that “the plant” is “trying to get sooner than 5/16 but advised me to give that date for now.”⁴⁴⁵ Similarly, a July 2016 internal email informs a number of Armstrong employees that “[w]e are having a manufacturing issue” and that “[t]he result is shortage of material to our customers starting today” for two fine-fissured school-zone SACT products.⁴⁴⁶ And a December 7, 2017 email chain states “that we continue to run out of stock on” a particular SACT product, and that “the tile is at zero and they are NOT making it until 12/18.”⁴⁴⁷ This demonstrates that sporadic short-term product shortages were a normal part of the market.

292. Moreover, Rockfon would have been even less likely to run into these sorts of logistical issues in the but-for world. As discussed above in Part A, the faster growth of Rockfon’s sales in the but-for world would have caused Rockfon to build its domestic manufacturing plant earlier, which in turn would have significantly reduced lead times and logistical complexity. Before the domestic manufacturing plant started operating, Rockfon had to import its North American SACTs from Poland, which required shipping the SACTs across the Atlantic and clearing customs before they even reached Rockfon’s U.S. warehouses.⁴⁴⁸ This long supply chain subjected Rockfon to additional risks, such as when the

⁴⁴⁵ AWI00099969 (May 5-6, 2016 email chain, with a May 6th email stating that “More black calla needed”) at AWI00099971 (another May 6th email, explaining that “I contacted the plant again and left [sic] them know that this is impacting your job. I will see what they come back with. They were trying to get sooner than 5/16 but advised me to give that date for now.”).

⁴⁴⁶ AWI00633248 (Jul. 22, 2016 internal email informing a number of Armstrong employees that “[w]e are having a manufacturing issue at Marietta” and that “[t]he result is shortage of material to our customers starting today” for products “[BP]1713 and [BP]1714,” and also noting that “We will be in a negative inventory position until Thursday, July 28th for customers shipping out of Marietta and on Monday, August 1st for customers shipping out of Macon.”).

⁴⁴⁷ AWI00635801 (Dec. 7, 2017 email stating “that we continue to run out of stock on Sepia tile [...] the tile is at zero and they are NOT making it until 12/18.”).

⁴⁴⁸ Medio Personal Deposition at 38; Medio 30(b)(6) Deposition at 19-20.

employees in a port that Rockfon relied on engaged in a strike.⁴⁴⁹ In contrast, once Rockfon built the domestic manufacturing plant, it could obtain SACTs without shipping them across the Atlantic or having to clear customs, thus shortening lead times and simplifying the supply chain significantly.⁴⁵⁰

⁴⁴⁹ John Medio (Rockfon President) 30(b)(6) at 19:12-20:7 (“Q. Did Rockfon experience any delays in shipments from Poland between January 1st, 2013 and the present? A. I'm sure we have, yes. Q. And do you have a sense of how frequent -- frequently Rockfon experienced delays in shipment? A. Not a specific time, but it happens often enough. When you're shipping product over the water, there are constantly changes in delays in schedules of the boats and the ports. And we experienced a port strike in Long Beach at one point in 2015, I think, 2016. I can't remember the exact date. Containers have taken a long time to get through port and Customs before. So in the broadest sense the word delays, yes, there's delays probably safe to say all of the time. But they're part of the normal way of doing business with a long supply chain.”).

⁴⁵⁰ Medio 30(b)(6) Deposition at 49-50 (explaining that producing domestically “removes supply chain risk” and reduces logistical complexity).

EXHIBIT A: EINER R. ELHAUGE CV

**Einer Richard Elhauge
Harvard Law School
1575 Massachusetts Ave.
Cambridge, Ma 02138**

**Tel: (617) 496-0860
Fax: (617) 496-0861**

**Hauser Hall 502
elhauge@law.harvard.edu**

EMPLOYMENT

Petrie Professor of Law, Harvard University

Subjects: Antitrust, Contracts, Health Law Policy, Statutory Interpretation.

Founding Director, Petrie-Flom Center for Health Law Policy, Biotechnology and Bioethics.

Member, ABA Antitrust Section Transition Task Force 2012.

Chair, Obama Campaign's Antitrust Advisory Committee

Co-Chair, Obama Campaign's Blogs and Op-eds Committee

Member, Obama Campaign's Health Policy Advisory Committees.

Member, Editorial Board for Competition Policy International

Member, Advisory Board for the Journal of Competition Law & Economics.

Member, Advisory Board for the Social Sciences Research Network on Antitrust Law & Policy.

Member, Advisory Board for the Social Sciences Research Network on Telecommunications &
Regulated Industries.

FTC Special Employee on Antitrust Issues.

Recipient, 2010 Jerry S. Cohen Memorial Fund Writing Award, for "Tying, Bundled Discounts,
and the Death of the Single Monopoly Profit Theory"

Recipient, Best Academic Anticompetitive Practice Article - 2015 Antitrust Writing Awards, for
"Robust Exclusion and Market Division Through Loyalty Discounts"

Recipient, 2016, Award for being one of the top 10 corporate and securities articles of the year,
for "Horizontal Shareholding"

Recipient, 2017 Jerry S. Cohen Memorial Fund Writing Award, for “Horizontal Shareholding”

Recipient, 2017, Society of Investment Law Prize for best investment law scholarship, for
“Horizontal Shareholding”

Books

ELHAUGE, U.S. ANTITRUST LAW & ECONOMICS (3d ed. 2018) (Foundation Press: 2d ed. 2011; 1st ed. 2008).

ELHAUGE & GERADIN, GLOBAL ANTITRUST LAW & ECONOMICS (3d ed. 2018) (Foundation Press: 2d ed. 2011; 1st ed. 2007)

ELHAUGE, ED., RESEARCH HANDBOOK ON THE ECONOMICS OF ANTITRUST LAW (Edward Elgar Publishing Ltd. 2013).

ELHAUGE, OBAMACARE ON TRIAL (2012), available at www.amazon.com

ELHAUGE & GERADIN, GLOBAL COMPETITION LAW & ECONOMICS (2D ED. HART PUBLISHING 2011; 1ST ED. 2007).

ELHAUGE, ED., THE FRAGMENTATION OF U.S. HEALTH CARE: CAUSES AND SOLUTIONS (Oxford University Press 2010).

ELHAUGE, STATUTORY DEFAULT RULES (Harvard University Press 2008).

AREEDA, ELHAUGE & HOVENKAMP, VOL X, ANTITRUST LAW (Little, Brown 1996).

Academic Articles

Brito, Elhaug, Ribeiro, and Vasconcelos, Modeling Horizontal Shareholding With Ownership Dispersion (Oct 2018), <http://ssrn.com/abstract=3264113>

Elhaug, *New Evidence, Proofs, and Legal Theories on Horizontal Shareholding* (Jan. 11, 2018), <https://ssrn.com/abstract=3096812>

Elhaug, *The Growing Problem of Horizontal Shareholding*, 3 ANTITRUST CHRONICLE 1 (June 2017)

Elhauge & Nalebuff, *The Welfare Effects of Metering Ties*, 33 JOURNAL OF LAW, ECONOMICS & ORGANIZATION 68 (2017)

Elhauge, *Contrived Threats v. Uncontrived Warnings: A General Solution to the Puzzles of Contractual Duress, Unconstitutional Conditions, and Blackmail*, 83 U. CHICAGO LAW REVIEW 503 (2016)

Elhauge, *Horizontal Shareholding*, 129 HARVARD LAW REVIEW 1267 (2016) (Awarded the Jerry S. Cohen Memorial Fund Writing Award for Best Antitrust Article, the Society of Investment Law Prize for best investment law scholarship, and an Award for being one of top ten corporate and securities articles of the year)

Elhauge, *Rehabilitating Jefferson Parish: Why Ties Without a Substantial Foreclosure Share Should Not Be Per Se Legal*, 80 ANTITRUST LAW JOURNAL 463 (2016)

McGuire, Drake, Elhauge, Hartman & Starr, *Resolving Reverse-Payment Settlements With The Smoking Gun Of Stock Price Movements*, 101 IOWA L. REV. 1581 (2016)

Elhauge & Wickelgren, *Robust Exclusion and Market Division Through Loyalty Discounts*, 43 INTERNATIONAL JOURNAL OF INDUSTRIAL ORGANIZATION 111 (2015) (Awarded Best Academic Anticompetitive Practice Article - 2015 Antitrust Writing Awards)

Elhauge, *How Italian Colors Guts Private Antitrust Enforcement by Replacing It With Ineffective Forms Of Arbitration*, 38 FORDHAM INT'L LAW JOURNAL 771 (2015)

Elhauge, *Obamacare and the Theory of the Firm*, in THE FUTURE OF HEALTH CARE REFORM (Malani and Schill, eds., U. Chicago Press 2015)

Elhauge, *Treating RAND Commitments Neutrally*, 11 JOURNAL OF COMPETITION LAW & ECONOMICS 1 (2015)

Elhauge, *I'm Not Quite Dead Yet—And Other Health Care Observations*, 49 TULSA L. REV. 607 (2014).

Elhauge, *Introduction and Overview to Current Issues in Antitrust Economics*, in Research Handbook on the Economics of Antitrust Law (Edward Elgar Publishing Ltd. 2013).

- Elhauge & Krueger, *Solving the Patent Settlement Puzzle*, 91 TEXAS LAW REVIEW 283 (2012)
- Elhauge, *The Irrelevance of the Broccoli Argument Against the Insurance Mandate*, NEW ENGLAND JOURNAL OF MEDICINE (Dec 21, 2011)
- Elhauge, *Why the Google Books Settlement Is Procompetitive*, 2(1) JOURNAL OF LEGAL ANALYSIS 1 (2010).
- Elhauge, *The Failed Resurrection of the Single Monopoly Profit Theory*, 6(1) COMPETITION POLICY INTERNATIONAL 155 (Spring 2010).
- Elhauge, *Why We Should Care about Health Care Fragmentation and How to Fix It*, in THE FRAGMENTATION OF U.S. HEALTH CARE: CAUSES AND SOLUTIONS 1 (Oxford University Press 2010).
- Elhauge, *Tying, Bundled Discounts, and the Death of the Single Monopoly Profit Theory*, 123 HARVARD LAW REVIEW 397 (2009). (Awarded 2010 Jerry S. Cohen Memorial Fund Writing Award for Best Antitrust Article).
- Elhauge, *Framing the Antitrust Issues in the Google Books Settlement*, GLOBAL COMPETITION POL'Y, (October 2009 Release 2).
- Elhauge, *How Loyalty Discounts Can Perversely Discourage Discounting*, 5 JOURNAL OF COMPETITION LAW & ECONOMICS 189 (2009)
- Elhauge, *Disgorgement as an Antitrust Remedy*, 76 ANTITRUST LAW JOURNAL 79 (2009).
- Elhauge, *Do Patent Holdup and Royalty Stacking Lead to Systematically Excessive Royalties?*, 4 JOURNAL OF COMPETITION LAW & ECONOMICS 535 (2008)
- Elhauge, *How Should Competition Law Be Taught?*, 4(1) COMPETITION POLICY INTERNATIONAL 267 (Spring 2008)
- Elhauge, *Harvard, Not Chicago: Which Antitrust School Drives Recent Supreme Court Decisions?*, 3(2) COMPETITION POLICY INTERNATIONAL 59 (Autumn 2007)
- Elhauge, *Can Health Law Become a Coherent Field of Law?*, 41 WAKE FOREST L. REV. 365 (2006).

Elhauge, *Sacrificing Corporate Profits in the Public Interest*, 80 N.Y.U. LAW REVIEW 733 (2005)

Elhauge, *Corporate Manager's Operational Discretion to Sacrifice Corporate Profits in the Public Interest*, in ENVIRONMENTAL PROTECTION AND THE SOCIAL RESPONSIBILITY OF FIRMS 13-76 (Bruce Hay, Robert Stavins, & Richard Vietor eds., 2005)

Elhauge, *Defining Better Monopolization Standards*, 56 STANFORD LAW REVIEW 253 (2003)

Elhauge, *Why Above-Cost Price Cuts to Drive out Entrants Do Not Signal Predation or Even Market Power – and the Implications for Defining Costs*, 112 YALE LAW JOURNAL 681 (2003)

Elhauge, *Preference-Estimating Statutory Default Rules*, 102 COLUMBIA LAW REVIEW 2027 (2002)

Elhauge, *Preference-Eliciting Statutory Default Rules*, 102 COLUMBIA LAW REVIEW 2162 (2002)

Elhauge, *The Lessons of Florida 2000*, 110 POLICY REVIEW 15 (Dec 2001 -Jan 2002).

Elhauge, *What Term Limits Do That Ordinary Voting Cannot*, CATO POLICY ANALYSIS, No. 328 (Dec. 16, 1998).

Elhauge, *Are Term Limits Undemocratic?*, 64 U. CHIC. L. REV. 83 (1997).

Elhauge, Lott & Manning, *How Term Limits Enhance the Expression Of Democratic Preferences*, 5 SUPREME COURT ECON. REV. 59 (1997)

Elhauge, *The Limited Regulatory Potential of Medical Technology Assessment*, 82 VA. L. REV. 1525 (1996).

Elhauge, *Allocating Health Care Morally*, 82 CALIF. L. REV. 1449 (1994)

Elhauge, *Toward a European Sale of Control Doctrine*, 41 AM. J. COMP. LAW 627 (1993)

Bundy & Elhauge, *Knowledge About Legal Sanctions*, 92 MICH. L. REV. 261 (1993)

Elhauge, *The Triggering Function of Sale of Control Doctrine*, 59 U. CHIC. L. REV. 1465 (1992)

Elhauge, *Making Sense of Antitrust Petitioning Immunity*, 80 CALIF. L. REV. 1177 (1992)

Bundy & Elhauge, *Do Lawyers Improve the Adversary System? A General Theory of Litigation Advice and Its Regulation*, 79 CALIF. L. REV. 313 (1991)

Elhauge, *Does Interest Group Theory Justify More Intrusive Judicial Review?*, 101 YALE L.J. 31 (1991)

Elhauge, *The Scope of Antitrust Process*, 104 HARV. L. REV. 667 (1991)

Media Publications

“Donald Trump: The Protector,” The Atlantic (March 2, 2016)

“Ted Cruz Is Not Eligible to Run for President,” Salon (Jan. 20, 2016)

“The Best Way to Reform Health Care—and Cut the Deficit,” The Daily Beast (January 6, 2013)

“Roberts' Real Long Game?,” The Atlantic (July 20, 2012)

“The Fatal Flaw In John Roberts' Analysis Of The Commerce Clause,” The New Republic (July 1, 2012)

“The Killer Precedent For Today’s Decision,” The New Republic (June 28, 2012)

“Even The Most Conservative Supreme Court Justices Have Already Declared Mandates Constitutional,” The New Republic (June 21, 2012) (with Emily Bass)

“What a Nobel Prize-Winning Economist Can Teach Us About Obamacare,” The Atlantic (May 23, 2012) (with Kevin Caves)

“A Further Response to Critics on the Founding Fathers and Insurance Mandates”, The New Republic (April 21, 2012)

“A Response to Critics on the Founding Fathers and Insurance Mandates”, The New Republic (April 19, 2012)

“It's Not About Broccoli!: The False Case Against Health Care,” The Atlantic (April 16, 2012)

“If Health Insurance Mandates Are Unconstitutional, Why Did the Founding Fathers Back Them?” The New Republic (April 13, 2012)

“Commentary: The Roberts-Kagan Compromise on Obamacare?,” The National Law Journal

(March 28, 2012)

"Don't Blame Verrilli for Supreme Court Health-Care Stumble," The Daily Beast (March 28, 2012)

"Economists Argue Over the Cost of Caring for the Uninsured," The Daily Beast (March 26, 2012)

"The Broccoli Test," New York Times (Nov. 16, 2011)

"Coverage vs Coercion," The Huffington Post (March 3, 2008)

"Rewire This Circuit," The Wall Street Journal, A26 (Sept. 17, 2003)

"Soft on Microsoft," The Weekly Standard (March 25, 2002)

"Despite What the Critics Say, it Wasn't a Bag Job," Boston Globe (March 3, 2002)

"Florida 2000: Bush Wins Again!," Weekly Standard (November 26, 2001)

"State Made The Right Call On Microsoft," The Hartford Courant (Nov. 9, 2001)

"States Should Seek More From Microsoft," San Francisco Chronicle (Nov. 6, 2001)

"A Smart Move on Microsoft," Boston Globe (Sept. 11, 2001)

"Competition Wins in Court," New York Times, (June 30, 2001)

"Bush v. Florida," New York Times, A31 (Nov. 20, 2000)

"Florida's Vote Wasn't 'Irregular,'" Wall Street Journal (Nov. 13, 2000)

"The New 'New Property'," San Francisco Chronicle (Nov. 6, 2000)

"The Real Problem with Independent Counsels," The Washington Times, A19 (Jun 30, 1999)

"Foul Smoke," The Washington Post, A15 (August 4, 1998)

"The Court Failed My Test," The Washington Times, A-19 (July 10, 1998)

"Microsoft Gets an Undeserved Break," The New York Times, A21 (June 29, 1998)

"Medi-Choice," The New Republic, 24 (November 13, 1995)

"Term Limits: Voters Aren't Schizophrenic," Wall Street Journal, A-16 (March 14, 1995)

Harvard Committees

Chair, Harvard Law School Lateral Appointments Committee (1998-99), Member (2003-05, 2011-2014).

Member, Harvard Law School Entry Level Appointments Committee (2009-2011).

Member, Harvard University Standing Committee on the Degree of Doctor of Philosophy in Health Policy (1996-99, 2006-07).

Member, Harvard University Internal Advisory Board for the Interfaculty Initiative in Health Policy (1996-99).

Member, Harvard Law School Lecturers and Visitors Committee (1996-98).

Past Academic Positions

1988-95	Professor of Law, Boalt Hall, University of California at Berkeley
1995	Visiting Professor of Law, Univ. of Chicago Law School
1994	Visiting Professor of Law, Harvard Law School
1993	Visiting Olin Faculty Fellow, Yale Law School
1991-92	Visiting Scholar in Europe at the Karolinska Institute, the Centre for Health Economics, the Rockefeller Foundation Study Center, Cambridge University, the European University Institute and the University of Florence

Clerkships

1987-88	Clerk for Justice William J. Brennan, Jr., United States Supreme Court
1986-87	Clerk for Judge William A. Norris, U.S. Court of Appeals for the Ninth Circuit
1986	Clerk for U.S. Solicitor General's Office, Washington, D.C.

Bar Admissions: Massachusetts (2000); Pennsylvania (1986); United States Courts of Appeals

for the Fourth (1997), Sixth (2008), and Ninth Circuits (1987); Supreme Court of the United States (1997).

ECONOMICS EXPERT WORK

President, Legal Economics LLC, 2007 to present.

Senior Expert at Criterion Economics LLC, 2004-2007

Recipient, 2016 AAI award for Outstanding Antitrust Litigation Achievement in Economics.

Named One of World's Leading Competition Economists in the *International Who's Who of Competition Lawyers and Economists*.

Testifying Expert in *Sitts v. Dairy Farmers of America, Inc.*, a case alleging a conspiracy to suppress raw milk prices.

Testifying Expert in *In Re Qualcomm Antitrust Litigation*, a case alleging tying and exclusive dealing involving modem chipsets and cellular standard essential patents.

Testifying Expert in *In Re Niaspan Antitrust Litigation*, a case alleging a reverse payment patent settlement.

Testifying Expert in *In Re Lamictal Direct Purchaser Antitrust Litigation*, a case alleging a reverse payment patent settlement.

Testifying Expert in *In re Namenda Antitrust Litigation*, a case alleging a reverse payment patent settlement and product hop.

Testifying Expert in *In re Lidoderm Antitrust Litigation*, a case alleging a reverse payment patent settlement.

Testifying Expert in *Valassis Communications v. News Corp*, a case alleging anticompetitive bundling and other exclusionary conduct.

Testifying Expert in *GN Netcom v. Plantronics*, a case alleging exclusive dealing in the distribution of contact center and office headsets.

Testifying Expert in *Louisiana Wholesale Drug v. Unimed Pharmaceuticals (Androgel case)*, a case alleging a reverse payment patent settlement.

Testifying Expert in *Garber v. Office of the Commissioner of Baseball*, a case alleging horizontal territorial restraints on broadcasting baseball games.

Testifying Expert in *Suture Express v. Cardinal Health*, a case alleging tying and bundled loyalty contracts in medical distribution.

Testifying Expert in *Savant v. Crestron*, a case alleging exclusive dealing in the high-end home control system market

Testifying Expert in *Castro et. al. vs Sanofi Pasteur*, a case alleging anticompetitive bundled loyalty contracts in the vaccines industry.

Testifying Expert in *In re Mushroom Direct Purchaser Antitrust Litigation*, a case alleging price-fixing in the fresh mushroom market.

Testifying Expert in *It's My Party, Inc. v. Live Nation, Inc.*, a case alleging anticompetitive conduct in markets for promotion and amphitheaters.

Testifying Expert in *Retractable Technologies v. Becton Dickinson*, a case alleging exclusionary contracts in syringe and IV catheter markets.

Testifying Expert in *Caldon v. Westinghouse Electric*, a case alleging attempted monopolization.

Testifying Expert in *King Drug v. Cephalon*, a case alleging that a reverse payment settlement of a patent dispute delayed entry and restrained competition in a pharmaceutical market.

Testifying Expert for the United States in *United States v. Wyeth*, a case involving claims of bundled sales and bundled discounts in a pharmaceutical market, which resulted in a \$784 million settlement for the United States.

Testifying Expert in *BAE Holdings AH v. ArmorWorks Enterprises*, a case alleging price discrimination by a ceramic tile manufacturer resulting in harm to downstream competition.

Testifying Expert in *In re Marsh & McLennan Companies, Inc. Securities Litigation*, a case alleging securities violations from failure to disclose bid steering.

Testifying Expert in *Tessera Technologies v. Hynix Semiconductor*, a case alleging conspiracy to exclude outside technologies from semiconductor markets.

Testifying Expert in *American Steel Erectors v. Local Union No. 7*, a case alleging boycott claims related to steel erection and labor markets.

Testifying Expert in *BP America v. Repsol*, an arbitration.

Testifying Expert in *Food Lion v. Dean Foods Company*, a class action alleging conspiracies to restrict and foreclose competition in milk markets.

Testifying Expert in *Eisai Inc. v. Sanofi-Aventis U.S. LLC*, a case by a rival alleging foreclosure in anticoagulant pharmaceutical markets.

Testifying Expert in *Daniels v. Tyco*, a case by a rival alleging foreclosure from sharps containers and GPO markets.

Testifying Expert in *Natchitoches Parish Hospital v. Tyco*, a class action concerning medical sharps containers and GPO markets.

Testifying Expert in *Amgen v. F. Hoffman La Roche*, concerning erythropoietin-simulating agents (ESAs) and white blood cell simulators (WBCs) pharmaceutical markets.

Testifying Expert in *White v. NCAA*, concerning markets for athletic and educational services.

Testifying Expert in *Applied Medical Resources v. Ethicon, Inc.*, concerning sutures, trocars, and GPO markets.

Testifying Expert in *Masimo Corp. v. Tyco Health Care Group*, concerning oximetry products and GPO markets.

Testifying Expert in *Rochester Medical v. Bard*, concerning catheter and GPO markets.

Testifying Expert in *Retractable Technologies, Inc. v. Becton Dickinson*, concerning syringes and GPO markets.

Testifying Expert in *Spartanburg v. Hill-Rom*, a class action concerning hospital beds and GPO markets.

Testifying Expert in *Mountain Area Realty v. Wintergreen Partners*, concerning conduct in the real estate brokerage services market.

Testifying Expert in *Louisiana Municipal Police Employees' Retirement System v. Crawford*, concerning merger in the pharmacy benefit manager market.

Testifying Expert in *Capital Credit Alliance v. National Automated Clearing House Association*, concerning electronic checks market.

Testifying Expert for Intel before EC and Korean antitrust authorities on microprocessor markets.

Testifying Expert for AmBev before the EC and Brazilian antitrust authorities on beer market.

Testifying Expert for 1-800-Contacts before the FTC on OSI-CooperVision merger and agreements restraining distribution by nonprescribing retailers.

Testifying Expert in *In Re Cardizem CD Antitrust Litigation*, concerning patents and pharmaceuticals.

Testifying Expert regarding the *B.F. Goodrich-Coltec* Merger, concerning the aerospace industry.

Testifying Expert regarding the *Alcoa-Reynolds* Merger, concerning the aluminum industry

Expert Consultant to National Cable Television Association on Internet Access Bills before Congress and Interactive Television Inquiry before FCC.

Expert for Royal Caribbean for proposed mergers of Princess with Royal Caribbean and Carnival, concerning the cruise industry.

Expert for the Medical Device Manufacturers Association, producing Report to U.S. Senate and Statement to FTC/DOJ regarding exclusionary agreements between medical device suppliers and Group Purchasing Organizations and their hospitals.

EDUCATION

Harvard Law School

J.D., June 1986

Awards

Fay Diploma -- for graduating first in class

Sears Prize -- Second Year -- to top two students in class

Sears Prize -- First Year -- to top two students in class

Activities

Harvard Law Review, Articles Office Co-Chair

Class Marshal

Author: *Modes of Analysis: The Theories and Justifications of Privileged Communications*, 98 HARV. L. REV. 1471-1500 (1985).

Harvard College

B.A., June 1982

Graduated in three years, majoring in Biochemical Sciences. GPA 3.9

PERSONAL

Born of Argentinian immigrants in New York City. First language was Spanish. Live with wife and 3 children in Newton, Massachusetts.

EXHIBIT B: STATEMENT OF PUBLICATIONS, PRIOR TRIAL AND DEPOSITION TESTIMONY, & COMPENSATION

I. Publications

My publications from the last 10 years are listed on my CV, which is attached as Exhibit A.

II. Trial and Deposition Testimony

Within the past four years, I have provided deposition testimony in *Suture Express v. Cardinal Health* on May 5, 2015; *Castro v. Sanofi* on July 13, 2016; *Louisiana Wholesale Drug v. Unimed Pharmaceuticals (Androgel case)* on October 14, 2016 and August 10, 2017; *GN Netcom v. Plantronics* on December 1-2, 2016; *In re Lidoderm Antitrust Litigation* on June 6, 2017; *In re Namenda Antitrust Litigation* on September 29, 2017 and November 10, 2017; and *In re Lamictal Direct Purchaser Antitrust Litigation* on June 7, 2018; *In Re Qualcomm Antitrust Litigation* on August 1, 2018; and *Sitts v. Dairy Farmers of America, Inc.* on November 6, 2018.

Within the past four years, I have also testified at trial in *GN Netcom v. Plantronics* on October 13 and 17, 2017. Other cases in which I have filed expert reports in the last four years are listed in my CV, which is attached as Exhibit A.

III. Compensation

I am being compensated at a rate of \$1250 per hour for my work on this case, and my consulting firm, Legal Economics LLC, is being compensated \$235-575 per hour for the work of my staff on this report.